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**British Institute of Persian Studies**

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# LINEAR BARRIERS OF NORTHERN IRAN: THE GREAT WALL OF GORGAN AND THE WALL OF TAMMISHE

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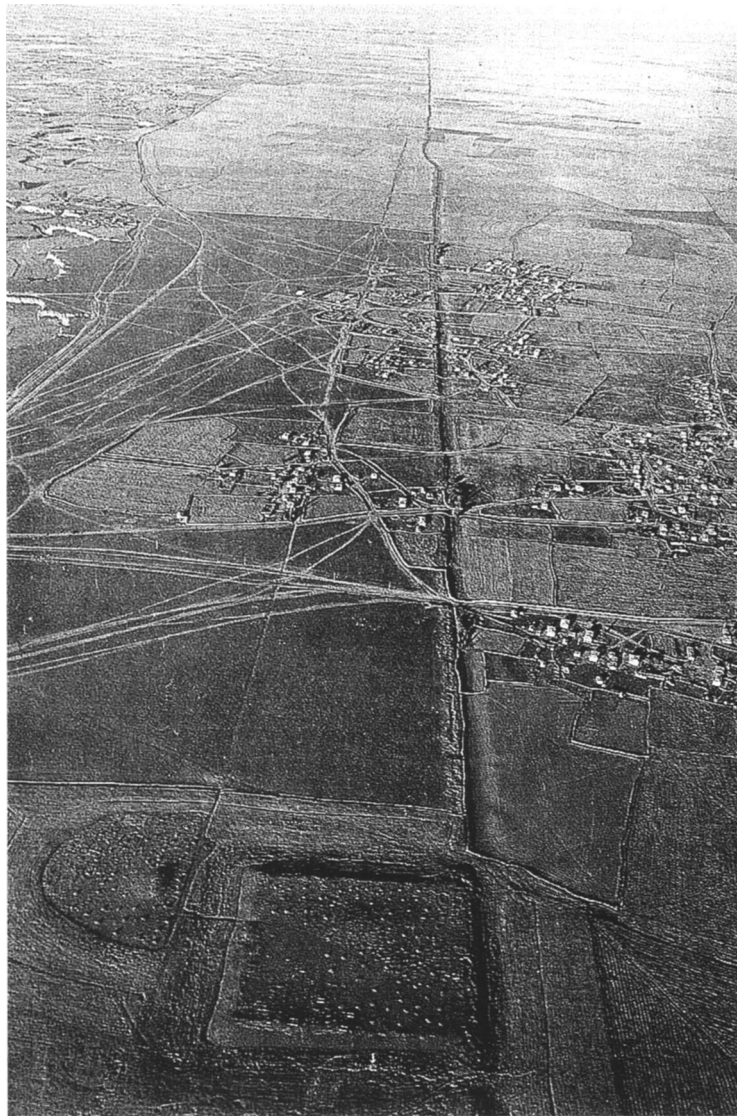
## INTRODUCTION (JN and ES)

The Great Wall of Gorgan (Fig. 1), also known as Sadd-i Iskandar ("Alexander's Barrier"), Sadd-i Piruz ("Barrier of Peroz"), Sadd-i Anushiravan ("Barrier of Khusrau") and Qizil-Alan ("the Red Snake"), is at least 195 km. long, including a c. 3 km. long gap, where the Pishkamar Rocks made an artificial boundary unnecessary (Figs. 2, 5; Nokandeh and Omrani Rekavandi 2003; cf. Charlesworth 1987; Talbert 2000: maps 96–97). It is, to our knowledge, the longest ancient barrier between the Hungarian Plain (Napoli 1997: 291–310; Kolník 1999) and China. The Great Wall of China (in fact not a single wall), made of, or faced with, stones or bricks, dates largely to the early post-medieval period and not, as commonly thought, to the 3rd century B.C. (Waldron 1990). The ancient predecessors of the Great Wall of China did not use ashlar or bricks, but locally available raw materials, such as earth, unworked stone and tamarisk wood (Lindesay 2003: 52–53, pl. 3, cf. 23, pl. 6; Lovell 2006: 42, 56–57, 71, 82; Stein 1912: 63, figs. 163, 165; Waldron 1990: 13–47). While some of these linear barriers were longer and remarkably sophisticated in signal transmission and in taking advantage of the terrain (Di Cosmo 2002: 141, 145–46; Lovell 2006: 24, 42–43, 46, 83, 91–92), they were of more basic and less durable construction. The scale of the Wall of Gorgan compares also favourably with that of the most elaborate ancient barriers in Europe. It is longer than its two famous British counterparts, the stone-built Hadrian's Wall and the Antonine Wall (an earthwork) taken together; only the 548 km.-long German "Limes" reaches a greater length than the Gorgan Wall. It is worth noting that the German "Limes" consisted in its most developed form of a rampart, ditch and palisade in the province of Germania Superior and a thin wall, presumably without walkway, in Raetia. The wall in Raetia was some 166 km. long (Braun

1984: 5). Thus, if we exclude earthworks, it appears that the Gorgan Wall may have been the longest wall anywhere in the ancient world.

The German "Limes", lacking insurmountable obstacles and its course paying little attention to the terrain, was designed as a line of control rather than an impenetrable defensive system. The Wall of Gorgan, by contrast, was wide enough (even its width appears to have been in most sections around 2 m., rather than the maximum observed 10 m.) to carry a walkway and was presumably a significantly more substantial obstacle. It is lined by a chain of forts, which, unlike the German "Limes" and like Hadrian's Wall, about the wall. 36 such military compounds, including three recently discovered along the eastern section of the wall (Nokandeh and Omrani Rekavandi 2003), have been identified along the wall. They range in size from c. 1.4 to 7.2 ha., not counting three small compounds, possible fortlets, of c. 0.03 to 0.12 ha. size (Nokandeh and Omrani Rekavandi 2003). This suggests that this massive linear barrier was designed to be manned by a substantial standing army.

The geographic location of the Gorgan Wall (Fig. 2), running from, presumably, the ancient shore line of the Caspian Sea into the Elburz Mountains in the East, leaves little doubt that one of its principal functions was to protect the Gorgan Plain and its hinterland from incursions from the north. Prior to the robbing of its bricks, ancient Persia's largest and most elaborate military monument must have left a deep impression on those who saw it. It was traditionally thought to have been erected by one of the most famous personalities in Ancient History, Alexander the Great, and is known as Sadd-i Iskandar ("Alexander's Barrier"), probably as a result of a modern identification of Alexander's legendary wall with this archaeological monument (Kiani 1982b: 11–12; Ferdowsi, *Shah-Nama* 20,4). A



*Fig. 1. The Gorgan Wall from the air: photo of fort 7 with its massive platform and the associated ditch, looking SW (© Georg Gerster, Zumikon/Switzerland).*

wall against the people of Gog and Magog is even mentioned in the Holy Qur'an (18, 94–97); it remains disputed, however, whether this passage refers to this or to a different border wall (Kiani 1982b: 12–13).

Yet, surprisingly, our knowledge of this monument is sketchy. No complete plan of any interior building in any of the forts is known, nor was there agreement on the date of its construction. H.L. Rabino once attributed the wall to Khusrau I. (A.D. 531–79) (Rabino 1928: 80) and once to Alexander the Great (who had reached the area in 330 B.C.), but rebuilt some nine centuries later under Khusrau I (Rabino 1928: 86). Erich F. Schmidt (1940: 55, cf. 56–57, 60, pl. 65), to whom we owe the

first aerial survey of the monument, dated it to “between the conquests of the Macedonians and the Arabs”. Others were more specific and often postulated a late Sasanian construction date (e.g. Frye 1977; cf. Kiani 1982b: 11–12 with references), on the authority of medieval and post-medieval sources, notably Ibn Isfandiyār (1,2 = Browne 1905: 27; cf. Kiani 1982b: 11). This 13th-century author attributed the wall to king Peroz (A.D. 459–84). Arguably more widely held is the view that the wall was the work of king Khusrau I (Bivar 1983: 214; Frye 1983: 160; Mattheson 2001: 35; cf. Tabari 896 = Bosworth 1999: 153; Kiani 1982a: 73 and 1982b: 11–12 with references). The most extensive



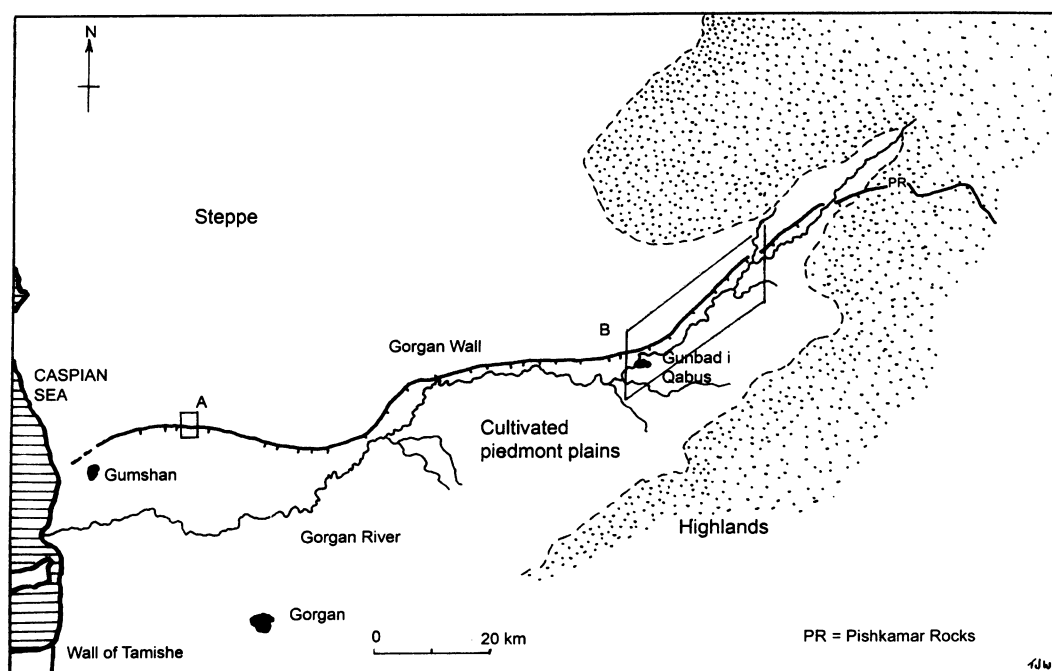


Fig. 2. Sketch map of the Gorgan and Tammishe Walls based on Kiani 1982b with amendments by TW, including the addition of the eastern section of the Gorgan Wall, based on research by JN. 'A' marks the location of Fig. 25, 'B' that of Fig. 16.

previous fieldwork project on the Gorgan Wall, including the compilation of detailed maps, was carried out in the 1970s by Dr M.Y. Kiani and led to a radical re-evaluation of the wall's chronology. Kiani (1982b: 37–38; 76–77) argued that the similarities between brick size and architecture of the wall and associated installations and those from other sites pointed to a Parthian date, as did the pottery spectrum, and the type of burials encountered in the excavations. Furthermore, Huff (1981) and Kiani (1982b: 38) postulated that the location of the wall's western terminal was hard to reconcile with the water level in the Caspian Sea at other proposed dates. Within the Parthian period (230s B.C. to A.D. 224/228) Kiani favoured an early construction, under king Mithridates II (123–87 B.C.) (Kiani 1982b: 38; 2003: 150) or Mithridates I (171–138 B.C.) (Kiani 1982a: 78), on historical grounds. The date of the wall, however, remained disputed. The majority from now on followed Kiani's dating proposal to the Parthian period (e.g. Ball 2000: 315–17; Van Wickevoort Crommelin 1998: 270 with no. 90; Wiesehöfer 2005: 654), most recently Jakubiak (2006: 142) and Brosius (2006: 89), the latter arguing for a construction as early as Mithridates I, even if some scholars stressed the uncertainty of proposed chronology or favoured a later

Parthian date (e.g. Olbrycht 1998: 240–41). Schottky (1998: 461–62, 468) argued for the later Parthian, if not Sasanian period and Haussig (1983: 125, 145) for an early Sasanian date, i.e. the second half of the 3rd century A.D. Harmatta (1996), interestingly without reference to Kiani's fieldwork, but with reference to and in opposition to Huff (1981), argued on historical grounds for a late Sasanian construction of the Gorgan Wall under Peroz, while Howard-Johnston (1995: 191, 193–94) believed that work on the Gorgan Wall started in the late 3rd century A.D. and that there could be little doubt that the Gorgan Wall and the walls on the west side of the Caspian Sea "reached an apogee of elaboration and strength in the sixth century", probably under Khusrau I. Boucharlat and Lecomte (1987: 192–94) put forward a Partho-Sasanian compromise solution; they followed Kiani's dating of the construction of the wall, but argued, almost exclusively on the basis of their interpretation of circumstantial written evidence, for a reoccupation of the wall after A.D. 284; the most important restoration of the wall occurred, in their view, without doubt under Khusrau I. That the wall and its associated forts were reoccupied or still occupied in Sasanian times had been widely accepted before (e.g. Kiani 1982b; Trinkaus 1984: 43). At the opposite end of

the chronological spectrum, A.D.H. Bivar considered recently, in the light of Kiani's discovery of early grey ware in association with the monument, the traditional attribution of the wall to Alexander the Great possible (Bivar 2003: 153); previously he had argued that the Gorgan Wall was the work of king Khusrau I, who had built it in response to the threat posed by the Hephthalites (Bivar 1983: 214).

It was the aim of our joint fieldwork project, between the Iranian Cultural Heritage and Tourism Organisation of Golestan Province and the University of Edinburgh, carried out in September and October 2005, to test to what extent modern archaeological techniques, notably geophysical survey, landscape survey, radiocarbon and optically stimulated luminescence dating, had the potential to shed light on the architecture, function and date of the important, yet enigmatic, Gorgan Wall and the nearby, shorter, Wall of Tammishe (Fig. 2). We hoped in particular that these techniques would allow us to narrow down the period of their creation within the proposed 900-year time frame as far as possible, thus enabling us to produce a meaningful historical interpretation. Our central historical questions included which, if any, of the recorded threats or incursions of the area may have motivated the construction of these elaborate monuments—or whether they may have been built during a phase of stability “as an insurance policy”. For the walls to function as effective barriers, the forts required a permanent garrison. Dating the system thus also promised to show which state possessed such a well-organised standing army.

#### *Physical Geography and Land Use (TW, JN and HO)*

The Gorgan Plain is located at the south-east corner of the Caspian Sea between the eastern ranges of the Elburz Mountains and the border with Turkmenistan to the north (Fig. 2). The plain consists of deposits from alluvial fans that debouch from the Elburz Mountains and interleaved deposits of the Gorgan River. The sedimentary accumulation also includes deep deposits of weakly-bedded loess deposits, through which the west-flowing Gorgan River has cut to form a broad, somewhat meandering gorge. Occasional abandoned river channels are evident, either as dry valleys (as is the case east of the dam at Sadd-i Garkaz, Fig. 18), or simply as relict meanders, the latter being evident on satellite images in the western plain.

To the west the plain is built up from the deposits of the Caspian Sea, which has left a subtle imprint in the form of extensive silt/clay plains, associated shoreline features and relict dunes. The slightly saline Caspian Sea has no outlet to the ocean, with the result that its level is primarily determined by the inflow of water from rivers (mainly the River Volga and Ural: Gerasimov 1978: 336), combined with precipitation minus the loss of water from evaporation. Overall, fluctuations in all of these factors have resulted in rises and falls of water level (Klige 1992; Mamedov 1997), although there is no consensus regarding the history of the level of the Caspian over the last 10,000 years of the Holocene period. According to Rychagov (1997) and Hoogendoorn (*et al.* 2005), after the later Pleistocene when the Caspian attained a low level of 50 m. or even more below its present level, the sea attained its present elevation (*c.* 28 m. below global sea level) shortly after 10,000 B.P. Following a high stand of *c.* -20 m. around 7000 or 6000 years B.P., the level dropped to around -30 to -32 m. below sea level a little before 2000 years ago attaining the present elevation a little after 1000 A.D. (Rychagov 1997). This so-called Derbent regression is important for an understanding of the construction of the Gorgan Wall because it implies that when the wall was constructed the level of the Caspian must have been some 2–4 m. below its present level. Such a low level would have allowed a wall to be constructed and to extend significantly further west (in the case of the Gorgan Wall), north (in the case of the Tammishe Wall) and east (in case of the Darband [or Derbent] Wall) and therefore to levels below the present level of the Caspian (see Amini *et al.* 2005). Other assessments place the Derbent Regression somewhat later, at around 1000 A.D., and according to a recent study there was a minor low stand of -30 to -32 m. of the Caspian level around A.D. 500 (Karpychev 2001: fig. 5); this would have allowed the two walls to have been constructed at a lower elevation. Unfortunately, at present there are too many contradictions in the reconstructions of the Caspian Sea level to produce a secure curve from independent geomorphological or stratigraphic indicators. Nevertheless, the probable presence of part of the Wall of Tammishe (now dated to the 5th to early 6th century A.D.), at a level below that of the modern Caspian Sea, implies that the sea level at that time was lower than that of the present day.

Thanks to its location adjacent to the Elburz Mountains, the southern part of the Gorgan Plain

receives approximately 600–700 mm. of rainfall per annum, a figure which falls rapidly to less than 400 mm. per annum along the Atrek River (Ganji 1968). The abundance of rainfall may account for the high density of archaeological sites that are evident throughout the southern part of the plain between the Gorgan River and the mountains (Arne 1945: fig. 3). Similarly it might account for the plain's reputation in the writings of medieval geographers who depict it as an area favoured by a fertile hinterland and which had the reputation of being the producer of cheap foods (Le Strange 1905 and Christensen 1993). Nevertheless, the region was also known for its numerous pestilences as a result of the "changeable and damp weather" (Christensen 1993: 161). Until a rigorous archaeological survey has been conducted of the region, it is difficult to state with any precision how the Gorgan Wall relates to long term patterns of settlement, but the map of T.J. Arne (1945: fig. 3) demonstrates that settlement was abundant to the south of the wall (indicated as the Kizil Alan). On the other hand, that a significant number of large sites existed to the north of the wall is clear from the maps of Kiani (1982b: figs. 30–31), which show at least six significant sites to the north of the wall. Overall, satellite images demonstrate that the most verdant lands occur to the south of the Gorgan Wall. This demonstrates that the Gorgan Wall was a defensive or territorial wall that bounded within and to the south of it the bulk (but by no means the entirety) of settlement.

Today, cultivated land use spreads well to the north of the wall, but in 1968 when the first edition of the Ministry of Agriculture land resources map was produced, the land use geography was much more clearly subdivided. The plains between the mountains and the Gorgan Wall were mainly piedmont and alluvial plains devoted to cultivation of rain-fed wheat, some irrigated cotton, with occasional patches of residual oak woodland. In contrast, to the north of the wall, large areas of the Gorgan and Atrek River plains and their interfluvies were steppe, saline steppe, or *Salicornia* steppe, predominantly under grazing with only occasional cultivation in the form of rain-fed wheat. The only deviation from this pattern was to the west, (north-east of the town of Gorgan) where a large area of saline steppe was devoted to a combination of grazing, waste land, and some wheat. Because the land north of the Gorgan Wall is climatically marginal for cultivation, it is not surprising that archaeological sites decrease rapidly towards the Atrek River. In this zone pastoral nomadism is the dominant form of land use. In

the early 20th century, when the area was first mapped by Europeans, much of the region is described as the camp grounds of Turkmen nomads (Survey of India and War Office 1920 and 1941), which was also the case in 1893 when Sir Percy Sykes visited the area (Wynn 2003: 15). Significantly for the interpretation of the wall, when Sykes visited the Russian commissioner at Gonbad-e Kavus, it was stated that the commissioner had been housed at that point specifically to reduce the cross border raiding of the Turkoman (Wynn 2003: 183). Whether this is viewed from the perspective of the Russians to the north, or the sedentary cultivators to the south, the line of the Gorgan River and wall (as well as the location of Gonbad-e Kavus) formed the approximate boundary between the nomads and the sown. There is little additional information on archaeological sites in the region, but an Italian survey has recorded a large number of post-Chalcolithic archaeological sites within the upper Atrek River basin (Venco Ricciardi 1985).

#### *Geophysical Survey of Fort 1 (JN, ES, DP, JR, HO and SU)*

Kiani (1982b: 16–38) carried out excavations within the interior of forts 12 and 13 and Nokandeh conducted further excavations in two of the small compounds (Nokandeh and Omrani Rekavandi 2003: 119; Nokandeh *et al.* 2005a: 240, 260). However, not a single complete building in any of the large forts is known, which is in sharp contrast to our detailed knowledge of Roman forts and fortresses. We hoped that geophysical survey would reveal the plan of some of the buildings, especially since Kiani's excavations (Kiani 1982b: 20, fig. 13) had shown that at least some fired bricks had been used for internal buildings within fort 12, including what appears to be the corner section of a building or room. To know more about the buildings within the forts promised to improve our understanding of the size and organisation of the contemporary army garrisoning these compounds. Only one geophysical survey of a fort on the wall, a magnetometer survey of fort 10 by Babak Amin Pour (Bastan Pajuh Geophysical Company) from February to March 2005, was carried out before. The results of this survey (Amin Pour 2005) are broadly similar to those achieved in fort 1.

Our joint team carried out a magnetometer survey (Fig. 3) of the entire area of Kiani's fort 1 (Kiani 1982b:

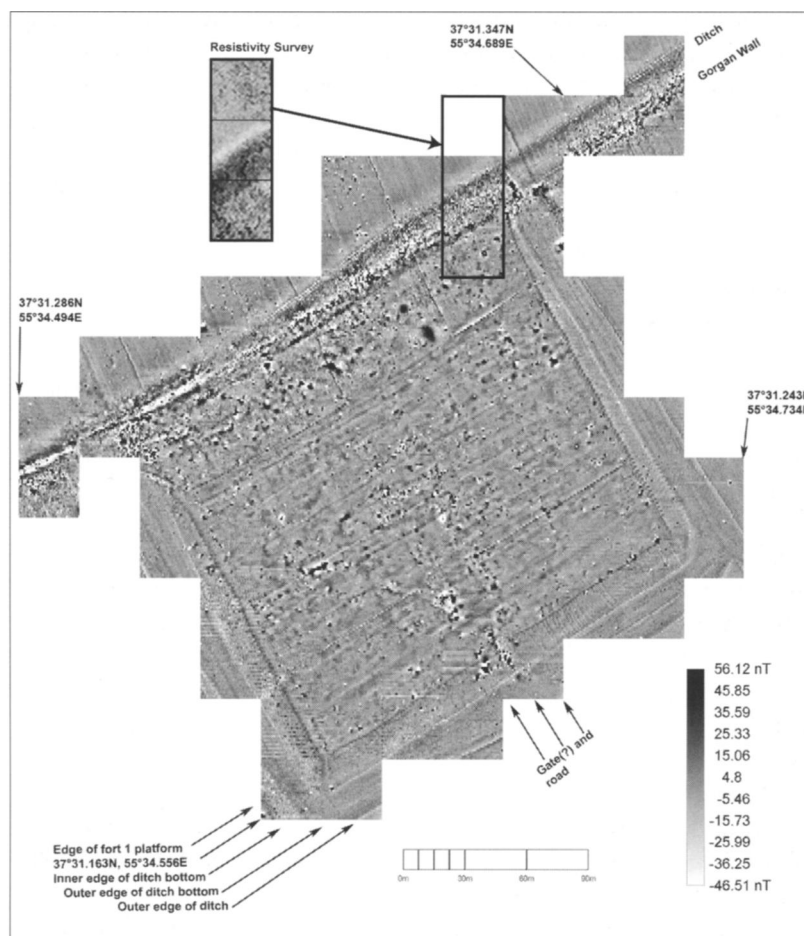


Fig. 3. Magnetometer survey (and resistivity survey in the inset) of fort 1, by JR, DP, HO, SU and Roger Ainslie (Abingdon Archaeological Geophysics). Each square corresponds to 30 x 30 m.

fig. 1) using a Bartington Grad 601 and a Geoscan FM256 Fluxgate Gradiometer, as well as a resistivity survey using a TR Systems Resistance Meter of selected areas.<sup>2</sup> We reused the base points of an earlier topographical survey of the fort by Sayed Hassan Husseini to facilitate comparison. This fort was selected, because it seemed to have significant potential as, despite major plough damage in some areas, the height difference between the edge of the fort and the bottom of the ditch still amounted to 5 to 7 m. for much of the WSW, SSE and ENE-facing sides. Furthermore, being the easternmost of the forts before the wall reaches the foothills of the Elburz Mountains, its strategic importance must have been considerable.

The magnetometer survey, unfortunately, revealed less about the interior layout of the fort than we had hoped. Numerous linear anomalies run from WSW to ENE, parallel to the long sides of the fort. Some of them

form distinctive narrow field boundary banks of very recent appearance, others are associated with ploughing patterns, and for none of them is there any certainty that they date back to antiquity. The same is true for a smaller number of SSE to NNW-running linear anomalies, even though two parallel central ones (discussed below) are probably associated with the original subdivision of the fort and, maybe, a central road.

Various smaller anomalies are discernible within the interior of the fort, but their significance (pits or magnetic or magnetised objects) and age eludes us. It seems that most of the interior buildings of the fort were made of materials which do not cause sufficiently strong anomalies to be detectable by geophysical survey, most probably mud brick (cf. Kiani 1982b: 19–21 with fig. 13). We must also allow for the possibility that there were yurts or sturdy tents. It seems improbable, in the



light of the postulated indicators for the forts housing troops permanently (see "The garrison of the Gorgan Wall forts"), that the scarcity of geophysically detectable interior structures was the result of the forts being empty or just occupied by short-lived temporary structures. The infrequency of fired brick fragments on the surface in the interior adds strength to our impression that this was probably not commonly used for non-defensive structures. Had any fired brick foundations been destroyed by ploughing (or even by robbing), then one would expect a higher concentration of fired brick on the surface. It appears that at present no non-destructive survey technique has the potential to reveal the interior layout of the fort in detail.

By contrast, the geophysical survey provided fascinating insights into the architecture of the defences of the fort and the wall beyond the fort. These features caused very distinct positive linear anomalies and there thus seems little doubt that they, like excavated sections of the wall, comprised fired brick. The use of this solid and durable building material appears to have been largely confined to these defences, and even there it seems to have been used sparingly. The reasons for this are not hard to guess. The production of fired brick was much more labour and resource intensive than that of mud brick.<sup>3</sup> The Wall of Gorgan, both where it is forming the NNW-facing side of fort 1 and beyond the perimeter of the fort, shows up as a wide band of high magnetisation. In the well-preserved section in the west (both east and west of the fort's western corner) this anomaly encompasses the steep slope south of the ditch and a 2 to 4 m. wide band on either side of the slope. The northern part of this broad anomaly is probably caused by tumble at the bottom of the slope (as in the case of fort 9), the southern by the wall itself. In the western part of the surveyed area, the NNW-facing section of the Great Wall is preceded on the enemy side by an as yet distinct slope; its continuation in the east, presumably flattened by ploughing, rises now at a much gentler gradient. The observation that the band of high magnetisation is traceable as a 7 to 8 m.-wide anomaly in the west, but as an up to 22 m.-wide one in the east is similarly most likely the result of much of the foundations of the wall in the east having been scattered and spread by ploughing. The resistivity survey, restricted to three grids, showed a linear, *c.* 19 m wide high resistance feature (probably the remains of the ploughed-out wall and its tumble), but yielded no results beyond those of the magnetometer survey.

A narrow linear anomaly follows the upper edge of the escarpment on the other three edges of the fort platform. The question arises whether this anomaly marks a thin retaining wall of fired brick, whose regular course determined that of the modern escarpment, or whether the magnetometer survey simply traces the modern edge of the plateau. It is worth noting that a high magnetic anomaly also marks the upper edge of the slope on the other side of the southern ditch, opposite the south-east corner of the fort, where one would not expect there to be a wall. Yet, it tends to be less pronounced. Whether or not there was a thin fired-brick retaining wall along the WSW-, SSE- and ENE-facing sides of the fort, one has to assume that these three sides of the fort were at least protected by a mud brick wall or an earth rampart, maybe with a mud brick façade. The massive ditch, best preserved in the south and east, would probably have provided material not just for the fort platform, but also for such a rampart or wall along its edges. Depending on the depth of ancient foundations and modern plough damage, excavation may have the potential to test many of these hypotheses.

Curious are two roughly parallel high magnetic anomalies close to the mid point of the SSE-facing side of the fort, the eastern being of rectilinear orientation, at a right angle to the defences and at the precise mid point of this side of the fort platform, the western being of less regular shape. Two parallel bands of high magnetisation, whose distance is about double that of the above anomalies, appear to run into the interior of the fort. The western representatives of either set of anomalies are in the same alignment, while the two bands and the fort as a whole share the same axis of symmetry. This axis coincides with the eastern anomaly on the SSE-facing side of the fort. There is nothing visible on the surface which could have caused anomalies of this strength. It is therefore possible that the bands represent structures or ditches lining a wide central road. The western anomaly at the SSE-facing side of the fort might be caused by the collapsed remains of the western pier or tower of a monumental gate, once providing the main or only access to the fort, made of fired brick with a particular concentration of the tumble spreading down the slope. Its eastern counterpart could either represent the collapsed remains of the central parts of a double gate or, possibly, canalisation consisting of ceramic pipes.<sup>4</sup> There are no clear traces of any anomaly likely to have been caused by brick tumble or the foundations of the

east side of such a postulated gate in alignment with the possible road. This might conceivably be explained by partial collapse and later robbing. The central symmetrical location of these anomalies within the fort is nevertheless best explained as a gate and a road.

If there was just a single gate and none on the enemy-side, then this would suggest that the wall was intended to be a barrier rather than a permeable line of control. The design of fort 1 was in this respect very different from its Roman counterparts which tend to have four gates (for ease of access and to allow sudden sorties). However, without extensive excavation there can be no certainty that there were no additional gates. Any gate above foundation level of the wall would be impossible to detect via geophysical survey. As the ditch preceding the wall carried deep flowing water (as discussed below), though not necessarily in this section, a gate may have necessitated the construction of a bridge (which, if it was made of timber, could only be found through excavation).

While an inspection on the ground of this and many other forts will be sufficient to demonstrate that we are dealing with rectangular enclosures, the geophysical survey has demonstrated how remarkably straight are the walls (or the modern edges of the plateau almost certainly following the ancient ones). The total area of fort 1 (including the outer edges of its walls) amounts to 3.9 ha. (205 x 182–199 m.), as opposed to Kiani's (1982b: 15, fig. 9) rounded figure of 4.8 ha. (240 x 200 m.). Unlike Roman forts, the corners appear to be square rather than rounded; like them, there is no doubt that

they represent meticulously planned complexes, built from scratch.

In contrast to Kiani's excavations of fort 13 (Kiani 1982b: 19, fig. 10; 1982a: 76), the nearby Sasanian fort of Tureng Tepe (Boucharlat and Lecomte 1987) and other fortifications of this or the Parthian period (such as the imprecisely dated forts in the Merv Oasis thought to be Parthian [Bader *et al.* 1992: 236–41; 1994: 120–26]), we found no traces of semicircular bastions protruding beyond the defences. It is worth noting, however, that the walls of the Köne Kishman fort in the Merv Oasis and the Sasanian defences of Tureng Tepe were built of mud brick and the same appears to be true for the western wall and bastion of fort 13. If any potential bastions at fort 1, whether part of the original design or added later, were constructed of local mud brick as well, then they may not be easily detectable. However, the remarkable straightness of all sides of the fort is hard to reconcile with the assumption that protruding bastions ever formed part of the defences. The close vicinity of forts 13, 12 and 11 raises the possibility that fort 13 and its bastions belong to a later phase (maybe to include a large tepe into the defended perimeter), rather than being associated with the original wall.

The ditch on the NNW-facing side, adjacent to the Great Wall, appears as a *c.* 6–8 m. wide anomaly (excluding a strip of very high magnetisation in the south, probably caused by wall tumble), but an inspection on the ground and a comparison with the ditch section next to fort 9 (to be discussed below), suggest that magnetometer survey in this particular environment



*Fig. 4. Magnetometer survey in progress SW of the E corner of fort 1, where the height differential between the current ditch bottom (despite ploughing) and the fort platform still amounts to an impressive 7 m.*



Fig. 5. The Pishkamar Rocks: a natural barrier between the western 175 km. of the Gorgan Wall and its eastern continuation (cf. Fig. 2); view from the vicinity of the eastern fortlet looking west.

often seems to be unable to detect ditches or to reveal more than some deposits within the ditch fills. The ditches on the SSE and WSW (Fig. 4) sides still survive as most impressive landscape features, 34 to 47 m. wide at the top and, even though erosion and ploughing will have substantially reduced their depth, they still reach 5 to 7 m. below the level of the fort platform.

*A possible Fortlet or Watchtower (JN, ES, DP, HO and SU)*

According to Kiani (1982b: 14, general map) the wall came to an eastern terminal not far from fort 1 “at the vertical rocks of Pishkamar”, i.e. the west of the Arab Dagħ (Fig. 5). Martin Charlesworth (1987) found parts of an eastern continuation postulated to run for another 15 km. Further parts of this eastern section were discovered in a recent survey under the direction of Jebrael Nokandeh (Nokandeh and Omrani Rekavandi 2003). While the wall west of fort 1 is running across mostly flat terrain, it reaches the mountain range of the Arab Dagħ, not far east of the fort. The ditch leading up the Arab Dagħ is amongst the best-preserved and most impressive sections along the entire wall. On top of the Arab Dagħ two suspected fortlets or watchtowers have been detected in the previous survey (Nokandeh and Omrani Rekavandi 2003); the eastern one was explored by partial excavations, but found to be heavily disturbed. A ditch surrounding this small compound, a dense brick concentration and its location at the western terminal of the Gorgan Wall’s eastern continuation

leave, nevertheless, little doubt that its interpretation as a military post is correct. No traces of the wall are known between these two posts. We carried out a magnetometer survey of the western post, a suspected watchtower. Our 30 x 30 m. grid was centred on a small artificial mound on the Pishkamar Rocks (Fig. 6), just beyond the point where the ditch of the Great Wall comes to a terminal and where, to judge by the brick scatter behind the ditch, the wall appears to come to a terminal as well. In order to prevent any distortion as a result of the modern artefact scatter on the ground, we collected surface bricks and placed them beyond the grid. Ground disturbance caused by an extensive Turkmen cemetery on the hill, including a small rectangular ditched feature on the summit of the artificial mound (probably a memorial specifically placed in this commanding position), had brought a dense scatter of bricks to the surface.

The geophysical survey revealed high linear anomalies. Two of them (in the SW and NW) appear to be rectilinear and join at a 90 degree angle. Two more are less clear and less straight, but may form the other two sides of a probable square with c. 16 m. outer diameter. Its clear SW-facing side appears to abut the Gorgan Wall in the NW. Our survey suggests that in the SW and NW foundations may survive *in situ* or, if robbed out, that there is at least still a brick scatter along the lines of the foundations. The less distinct traces on the two opposite sides suggest worse preservation, perhaps as a result of erosion and the bedrock probably being closer to the surface.





*Fig. 6. Brick scatter at the site of the probable western watchtower or fortlet on the Pishkamar Rocks, overlooking fort 1.*

The massive proportions of the ditch leading up to the location of this possible watchtower may be explained by the fact that the terminal of one section of the wall was particularly vulnerable. The steep south-facing rock face of the Arab Dagħ (Fig. 5) would have formed a formidable obstacle to the progress of any invading force, especially a mounted army, unable to storm the wall and/or take the fortlet or watchtower. While the ascent to the Arab Dagħ from the north would have been perfectly feasible, it was the steepness of the SSE-facing side, which made a continuation of the wall between the two small posts on either end of the rocky slope unnecessary. From the eastern post the wall led down to a small fortlet or other compound in the valley, which has been recently excavated by Jebrael Nokandeh.

No (other?) towers have, to our knowledge, as yet been found along the Gorgan Wall, though one was found on the Tammishe Wall (Bivar and Fehérvári 1966: 42, pl. IIb). In the light of the small scale of excavations so far, the absence of evidence should not be seen as evidence of absence. More fieldwork and inter-visibility studies are required to locate more towers or fortlets and to understand what role, if any, they played in signal transmission along the wall.

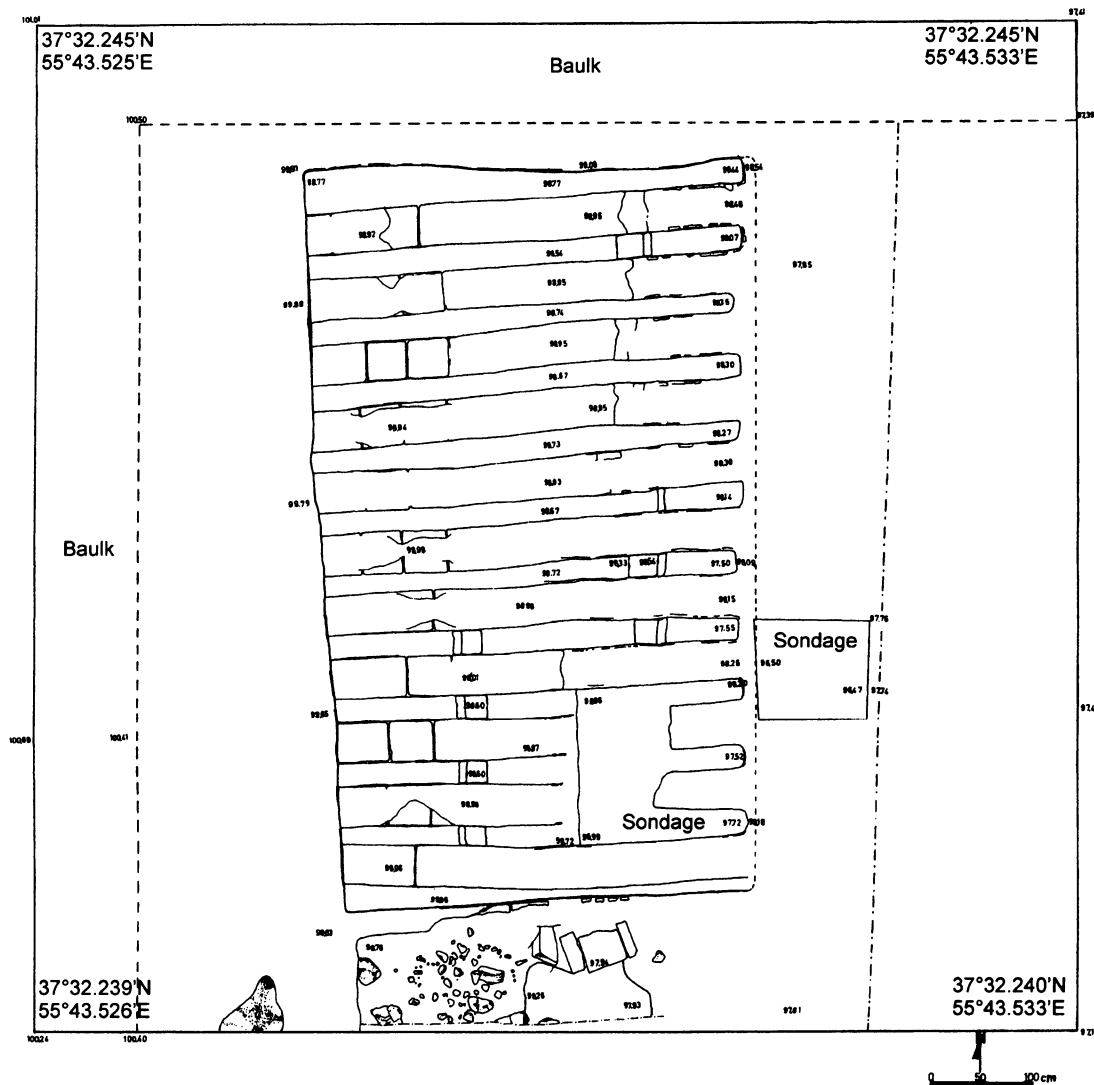
#### *A Brick Kiln in the eastern section of the Great Wall* (JN, ES, GA and MM)

A brick kiln, located previously in a survey by Jebrael Nokandeh, was selected for excavation in the hope that

it would yield burnt surfaces suitable for optically stimulated luminescence (OSL) dating and material (e.g. charcoal) suitable for radiocarbon dating. Parts of the grill and of the outer wall were visible on the surface of the steep slope. A 10 x 10 m. grid was geophysically surveyed twice, once walking up the slope and once parallel to the slope. It revealed a strong positive anomaly extending over some 7.30 m. (north to south) x 3.90 m. (west to east). The highest readings were in the south, suggesting that the kiln was fired from this side. On the basis of these surveys a trench (A) of 9 x 9 m. was excavated (Fig. 7). The principal aim of the excavation (as well as of that of a kiln next to the Tammishe Wall discussed below) was to yield dating evidence for the walls. We therefore confined ourselves to a partial excavation of the kiln. A significant proportion of the kiln's fill was left *in situ*, as a sediment overburden over the combustion chamber's fire-reddened bottom was required for OSL sampling.

In theory, of course, it cannot be excluded that the selected kilns on the Gorgan and Tammishe Walls date to a later repair phase of the walls rather than their original construction and/or were reused at a later date; in the latter case charcoal and OSL samples could provide the date for the time of the last firing. However, the comparative uniformity of brick size and wall architecture renders it unlikely that the walls underwent a repair on such a massive scale. It is worth pre-empting that there proved to be a significant overlap between the radiocarbon and OSL dates eventually obtained from the two excavated kilns and the OSL dates from nearby





Plan of brick kiln (trench A)

The Great Wall of Gorgan Project 2005

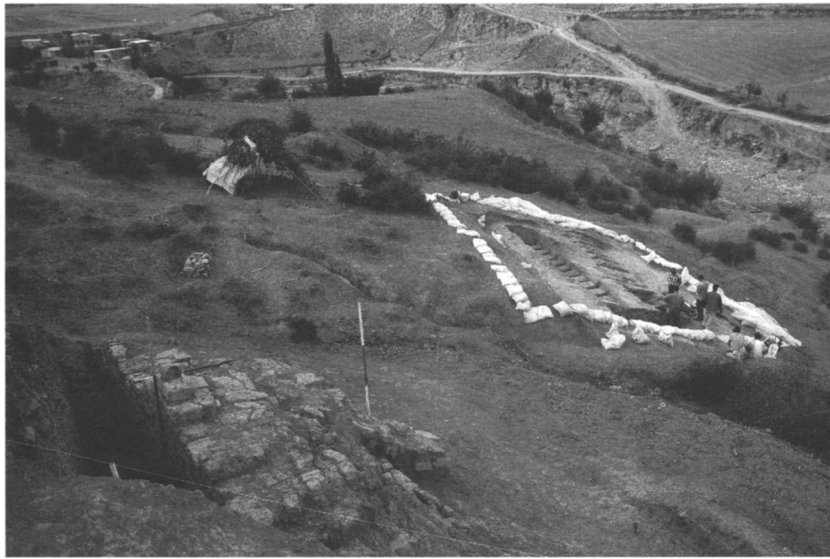
Drawn by M. Hussein-Zadeh

Fig. 7. Plan of trench A by Maryam Hussein-Zadeh: a brick kiln next to the Gorgan Wall. The GPS measurements refer to the corners of the trench, the heights to the benchmark for trenches A, C, D and E, set arbitrarily at 100 m. Note that the long sides of the square bricks lying on top of the crossbars and those in front of the stoke hole are of identical length (40 cm) to that of those used in the wall.

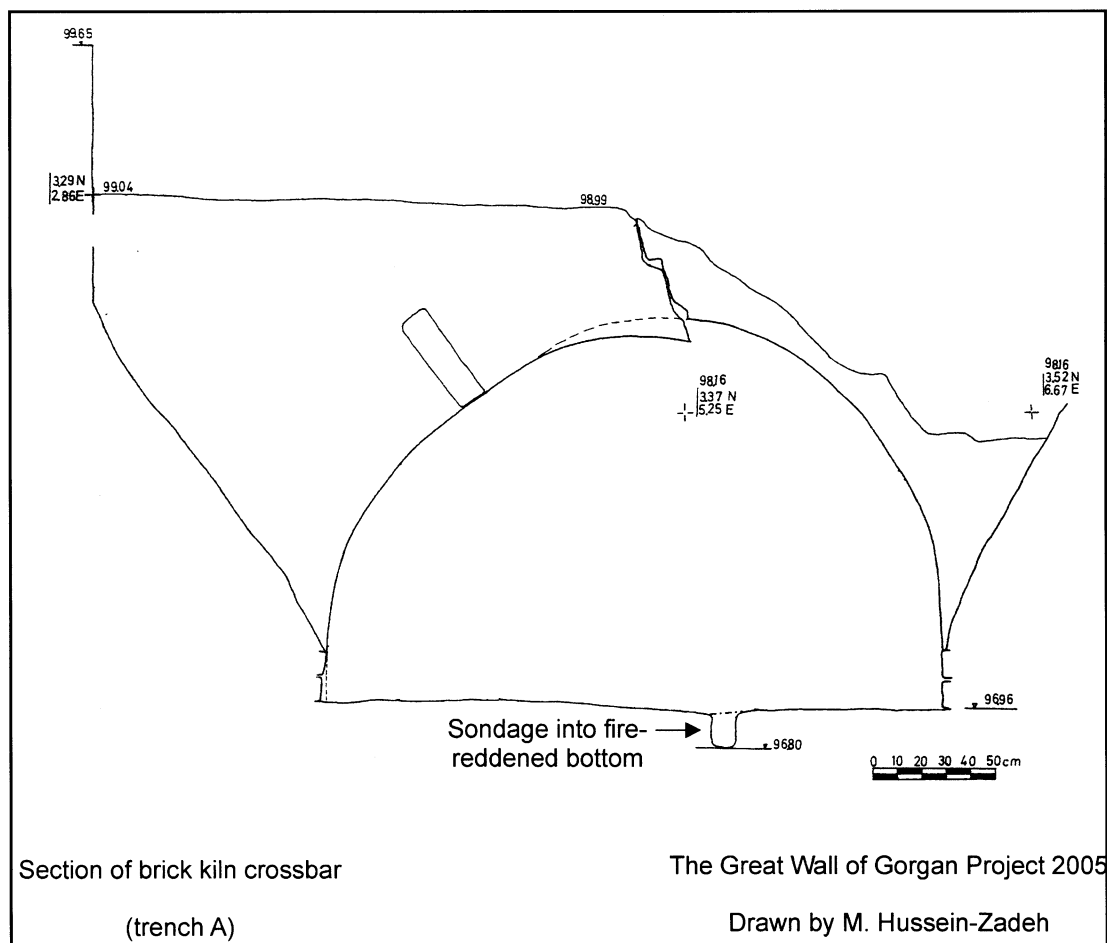
sections of the walls themselves, as well as a radiocarbon date from a bone from the ditch next to fort 9 (discussed below). This suggests that all episodes of firing of the excavated Gorgan Wall kiln belong to the same phase as the adjacent section of the Wall, and that similarly the excavated Tammishe kiln was used only for producing bricks for the original construction of this Wall. Unlike a Sasanian pottery kiln at Tal-e Malyan, whose floor was

replastered at least 16 times (Alden 1978: 81), there is nothing to suggest that the excavated Gorgan and Tammishe brick kilns were used repeatedly over an extended period of time.

The west side of the kiln is located merely 13 to 16 m. east of the east face of the wall (Figs. 8, 12) on a steep slope with no signs of occupation in the immediate proximity in other periods. There can thus be little doubt



*Fig. 8. The Gorgan Wall (trench E) in immediate vicinity of the brick kiln (trench A).*



*Fig. 9. The south-facing side of the fourth crossbar from the south of the brick kiln next to the Gorgan Wall in trench A by Maryam Hussein-Zadeh.*

that it was specifically built to produce bricks for the wall. Its dimensions (7.20 x 4.20 m.) are strikingly close to those of the kiln in a similar vicinity to the wall (7.15 m. length x 2.75 m. internal or c. 4.20 m. external width), excavated by Kiani (1982b: 17, 18, fig. 11) in the 1970s. Both kilns share a similar rectangular shape, even if no remains of the raised oven floor or its support appear to have survived in Kiani's kiln. A worse state of preservation may also account for the lower depth of 2.00 m. recorded for Kiani's kiln, as opposed to 2.95 m. (bottom of kiln in the sondage to the top of the surviving western wall, but only c. 2.01 m. from bottom of kiln and base of eastern mud brick wall to the top of the arches) for the kiln excavated as part of our joint project (Fig. 9). These architectural similarities add further strength to our assumption that both kilns must have been built specifically to produce bricks for the wall. The stream in the valley below our kiln would have provided the water required for brick production. It is unlikely that fuel would have been in short supply, as today the slope is covered in scrub (and a dense layer, A.010, according to Rowena Gale's charcoal analysis, of charred scrub, ideal as fuel [Matson 1985: 71–73],

was found at the bottom of the combustion chamber), and forested mountains are within sight.

The support for the raised wall of the kiln consisted of eleven interconnected cross-wall supports with arched openings. The top of the cross-walls was level, but they were only fully preserved in the west (i.e. on the side facing the hill), while their uppermost section has been destroyed in the east. The narrow spacing and solid construction of the cross-walls suggest that the kiln floor was designed to carry substantial weight, needed to produce a major quantity of bricks during each episode of firing. For the same technical reasons, Roman tile or brick kilns are also often large and rectangular, and were provided with narrowly spaced arched cross-walls capable of supporting heavy loads (Swan 1984: 87–89). Not surprisingly, its architecture differed from the geographically closer early Sasanian roundish pottery kiln at Tal-e Malyan (Alden 1978), not designed for such heavy material. The east-facing outer wall of our kiln was made of mud bricks. The south-facing outer wall consisted of clay and mud bricks. The north-facing and west-facing sides have not been excavated, and it seems likely that in the west the kiln had been cut into the natural slope. The

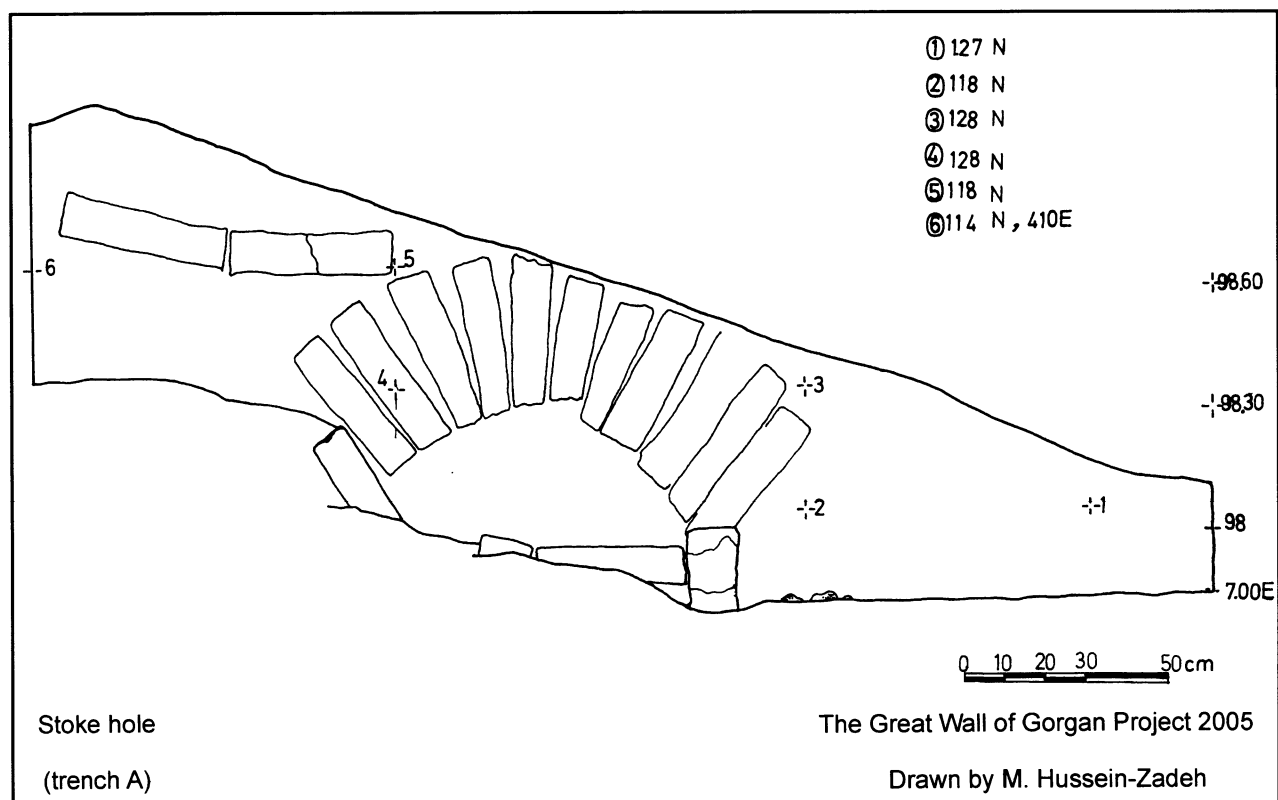


Fig. 10. The south-facing stoke hole of the brick kiln next to the Gorgan Wall in trench A by Maryam Hussein-Zadeh.

stoke hole on the south-facing side (Fig. 10) and its vicinity, notably the mud bricks in the arch above it, had been subjected to intensive heat and were fire-reddened. In front of the stoke hole we observed three fired bricks symmetrically arranged. None of the bricks was complete, but one long side each, on two of them, was fully preserved, in either case measuring 40 cm., and thus corresponding to the typical dimensions of bricks from the wall. The western slope above this access passage or extended flue was densely paved with rounded river pebbles from c. 3 to 25 cm. diameter in a matrix of soft

mid-brown clayey silt (context A.006). They must have been brought up from the river in the valley and placed there intentionally to prevent erosion and mud from being washed into the kiln; the alluvial layer which overlay them contained less than 1% stones (as opposed to an estimated 80% in context A.006), mostly of small diameter and no rounded river pebbles.

After its abandonment, the kiln was covered by a thick layer of very soft mid-brown clayey silt (context A.002), which ensured that most of the structure, especially on the hillside, survived to the present day. Apart from a small

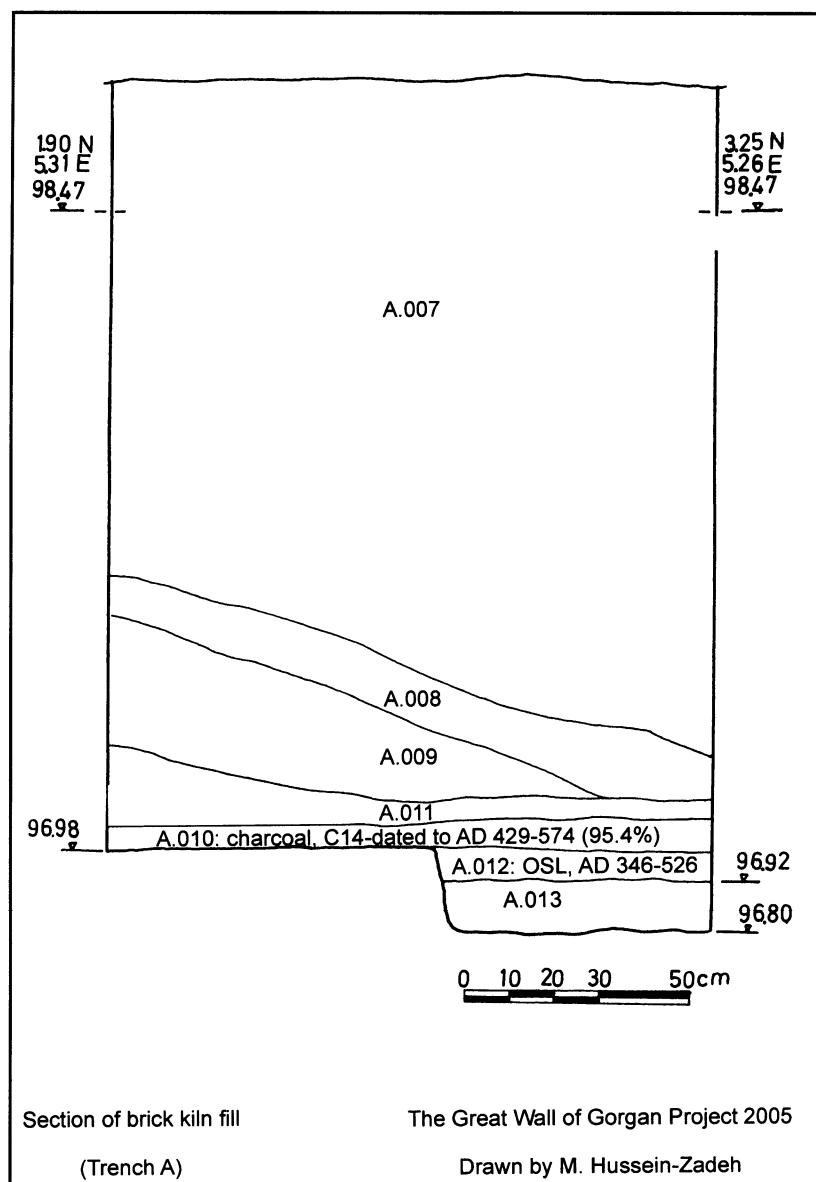


Fig. 11. The fill of the brick kiln next to the Gorgan Wall, including a sondage into the fire-reddened natural, in trench A by Maryam Hussein-Zadeh.



number of undatable sherds, this deposit was quite sterile, and it must represent material washed down the steep slope as a result of erosion, possibly resulting from a destruction of the natural plant cover.

The second and third arch from the south had partially collapsed in the east, and the area affected was large enough to enable us to excavate a sondage (Fig. 7) into the interior of the kiln without destroying any preserved architecture. A deposit (A.007), similar to the one (A.002) which had covered substantial parts of the kiln, filled most of its interior (Fig. 11). Towards the south of the test pit and within the kiln we observed a small ramp consisting of friable mid-reddish brown coarse sand with c. 60% brick fragments (A.011) and a very soft mid-yellowish brown clayey silt (context A.009), similar to A.007, but with a higher proportion of brick fragments. This was stabilised on the top by a stony layer (A.008), which formed a regular slope which linked the bottom of the stoke hole with that of the combustion chamber. No traces of fire-reddening *in*

*situ* were observed on this ramp, and its function remains enigmatic. Sealed underneath this ramp and immediately above the fire-reddened bottom of the kiln (A.012 and A.013) a c. 5 cm. thick deposit (A.010) of dark blackish brown medium sand was found which contained an estimated 60% charcoal. This must relate to a period of firing, and it is from this deposit that a sample for radiocarbon dating was taken.

#### *The Gorgan Wall (JN, ES, GA and MM)*

Three further 10 x 10 m. grids were surveyed on the steep slope above the kiln to locate the wall itself. Despite clearing of the scrub, the results were less clear than anticipated, probably because of the unevenness of the ground, the collapse of the wall, the resulting wide scatter of bricks in the vicinity of the wall's foundations and later unsystematic brick robbing. Partially on the basis of this survey and, more importantly, on the basis

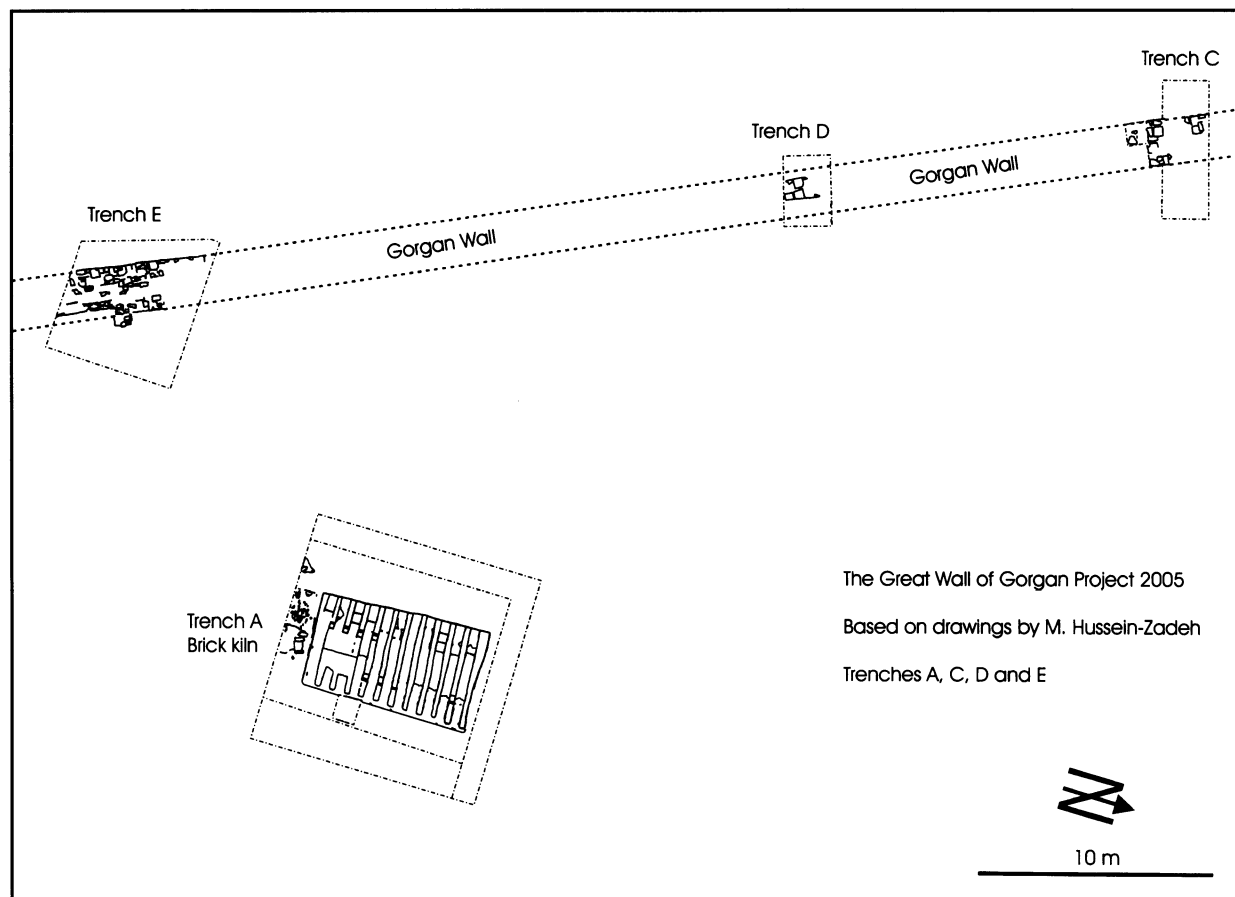


Fig. 12. Location plan of the Gorgan Wall and the adjacent brick kiln (trenches A, C, D and E).

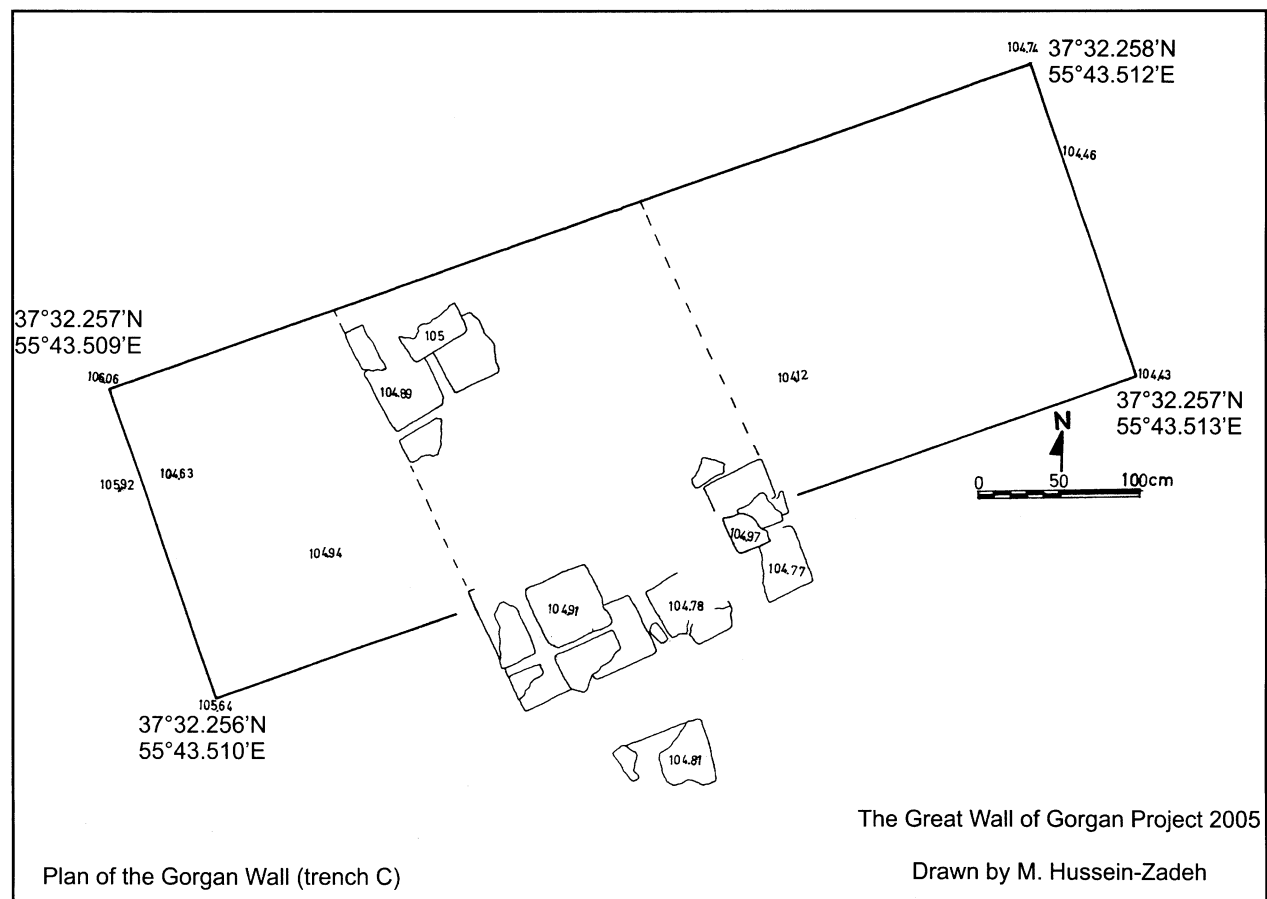
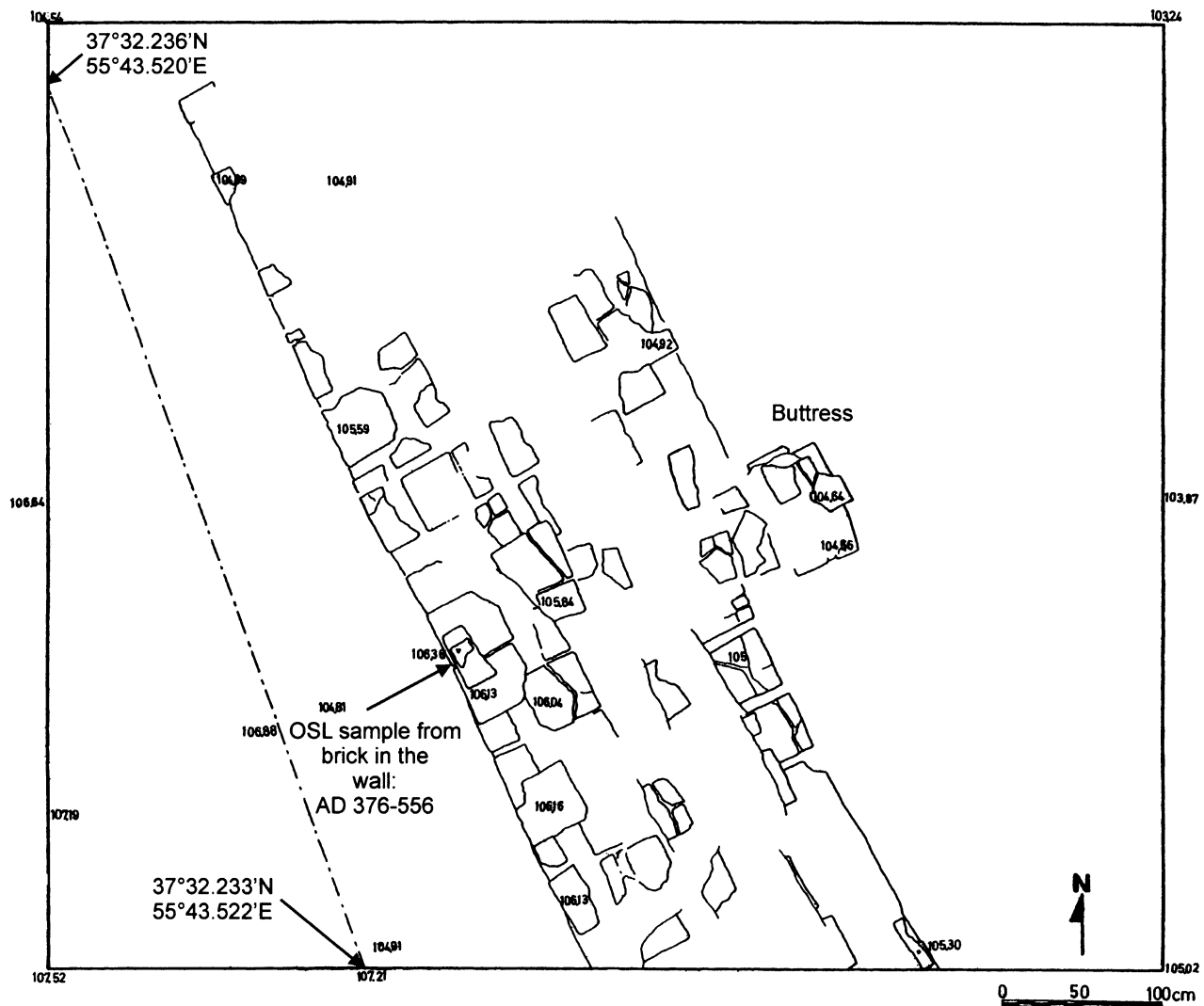


Fig. 13. Plan of trench C by Maryam Hussein-Zadeh: the partially robbed-out Gorgan Wall. The heights refer to the benchmark for trenches A, C, D and E, set arbitrarily at 100 m.



Fig. 15. Trench E: a section of the Gorgan Wall next to the brick kiln (trench A), surviving to a height of 1.47 m.



The Great Wall of Gorgan Project 2005

Plan of the Gorgan Wall (trench E)

Drawn by M. Hussein-Zadeh

Fig. 14. Plan of trench E by Maryam Hussein-Zadeh: the Gorgan Wall on a steep slope with a buttress. The GPS measurements refer to the corners of the trench, the heights to the benchmark for trenches A, C, D and E, set arbitrarily at 100 m.

of visible remains of the wall at heavily eroded spots on the slope and the alignment of uncovered bricks *in situ*, three further trenches (C, D and E) were successively marked out (Fig. 12). In all three trenches a section of the wall was found, though it was heavily robbed in trenches C and D. Both edges were found in trench C (Fig. 13), but only parts of the core in trench D. In trench E (Figs. 14, 15) the wall was best preserved. On the hill-facing side 13 courses/1.47 m. were still standing; the preservation on the eastern side, where the

bottom two courses of a buttress were found, was worse. Earlier excavations by Jebrael Nokandeh have revealed that the wall was supported with similar buttresses some 165 m. further south on the same side of the valley, presumably the steepness of the slope necessitating such structural support. The defensive wall used the gradient of the terrain very effectively in this area. Any hostile force would have had to negotiate a steep ascend to the wall and it would have been difficult for them to gain a firm foothold, let alone

launch an effective attack, if the wall had a walkway and was defended.

The soil profiles in trenches C and E suggest that the foundations of the wall on the hill-side reached merely some three to four courses below the ancient land surface. There is no firm evidence for an earth bank behind the wall in trench E; it is more likely that the substantial deposit of soft mid-yellowish brown clayey silt (E.002) built up behind the wall as a result of later erosion, and thus helped to preserve it. In trench C, unlike E, a deposit of soft light-reddish brown clayey silt with c. 25% brick fragments overlies the four course-high preserved back of the wall and extends at a similar level to behind the wall's back side. Its formation is most probably the result of brick robbing and the erosion of the spoil, thus attesting that there was no earth bank behind the wall or that it has been removed in the area of the trench. The absence of a ditch in front of the wall on this steep slope renders it more likely that there never had been an earth bank behind the wall, especially as the material would have been difficult to obtain and the weight would have had an adverse impact on the wall's stability. By contrast, the remains of a probable earth bank survive on the southern side of the wall where it is cut by a modern canal at 37° 17.038' north and 55° 11.214' east near Gonbad-e Kavus. Here the ditch north of the wall would have provided a ready source for material.

The width of the wall amounted to five rows of bricks, i.e. c. 2 m. in this section as well as in trenches C and E. The enemy-facing side of the fort walls may have been more substantial than the wall between forts, as suggested by the broad linear high anomalies in the magnetometer surveys of fort 1 and 9. In fort 13 the wall near the north-west corner was found to be 10 m. wide (Kiani 1982b: 17, figs. 10, 12). Such width at the base may suggest that this wall reached greater height and was provided with a broad walkway, capable of being manned by a substantial number of soldiers.

#### *The landscape survey (TW, JN and HO)*

Defensive or territorial features like the Gorgan Wall are inextricably part of the landscape, and it is therefore necessary to visualise them within such a context. This is not simply an academic exercise but, as was demonstrated during the 2005 field season, the broader investigation of the landscape provides insights into the overall function of the wall. Here landscape is taken to

comprise not simply the physical landscape of the Gorgan River valley, but also the cultural landscape comprising the settlement geography of the Gorgan Plain itself, as well as hydraulic and other features that were specifically related to the wall.

#### *Hydraulic Features Associated with the Gorgan Wall (JN, TW and HO)*

Although the line of the Gorgan Wall follows the approximate divide between the densely settled landscape to the south from the agriculturally marginal and sparsely settled lands to the north, there were two major anomalies. First, several large sites of Partho-Sasanian date were evident beyond and to the north of the wall (Kiani 1982b), therefore outside its protection, and second the wall could be seen to follow a course remarkably parallel to the Gorgan River, rather than following a line that might be regarded as more strategically defensive. This curious alignment is now partly explained by recent discoveries made by Jebrael Nokandeh and his colleagues (Nokandeh 1999) and further investigations made during the 2005 field season.

Three canals were observed, first by Jebrael Nokandeh (1999: 171–72, figs. 194–96, 212–16, 222–23) and his team, leading from the valley of the Gorgan River towards the Gorgan Wall. During fieldwork in 2005 each canal was followed on foot to ascertain the relationship of the canal to the river itself, and each could be seen to lead approximately from the edge of the river valley towards the Gorgan Wall, where in each case the canal flowed through what appears to have been a deliberately constructed gap in the wall to merge into the ditch located on the north side of the wall. The three cross canals visited were, from east to west (Fig. 16): Chai Ghushan Kuchek, Aghabad and Sarl-i-Maktoom.

Of these, the central Aghabad canal was the most clearly defined, consisting of a central channel 11–12 m. across with banks of upcast spoil on both sides. This canal and the western Sarl-i-Maktoom both joined the Gorgan Wall ditch via a clear junction. Although the precise architectural relationship between the upcast banks of the canal and the wall were unclear, the upcast mounds appeared to overlie the wall itself. The canal and the Gorgan Wall ditch were of similar size when measured on the ground (c. 12 m. in this area), but this does not allow for any sedimentation and infill, hence when excavated the overall width of the ditch appears to



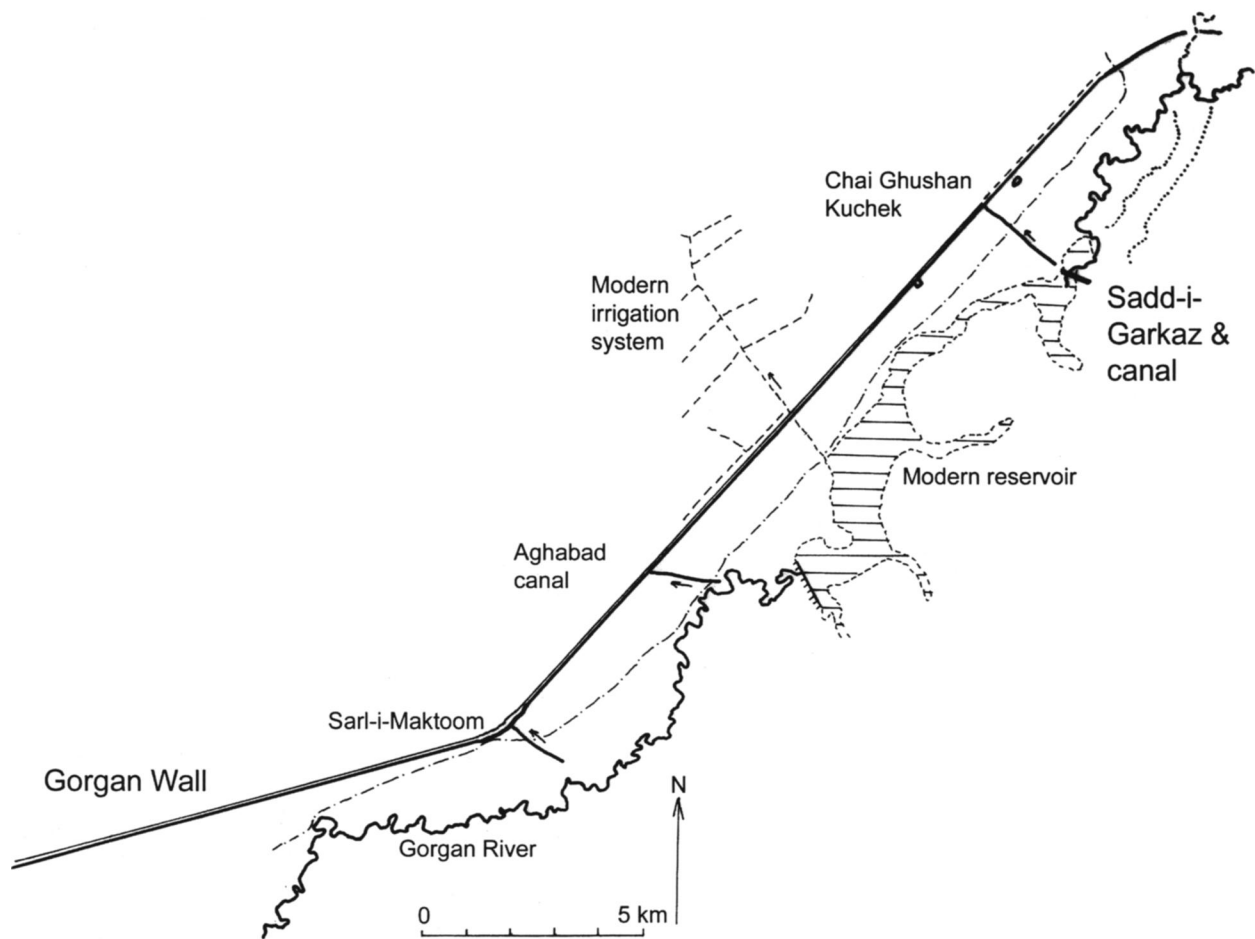


Fig. 16. The Gorgan Wall to the NE of Gonbad-e Kavus (cf. Fig. 2) showing the three canals linking the Gorgan River with the Wall, and the location of the Sadd-i Garkaz. Note how the modern irrigation system also transfers water from the Gorgan River to the loess plateau by means of a reservoir.



Fig. 17. The Chai Ghushan Kuchek canal.

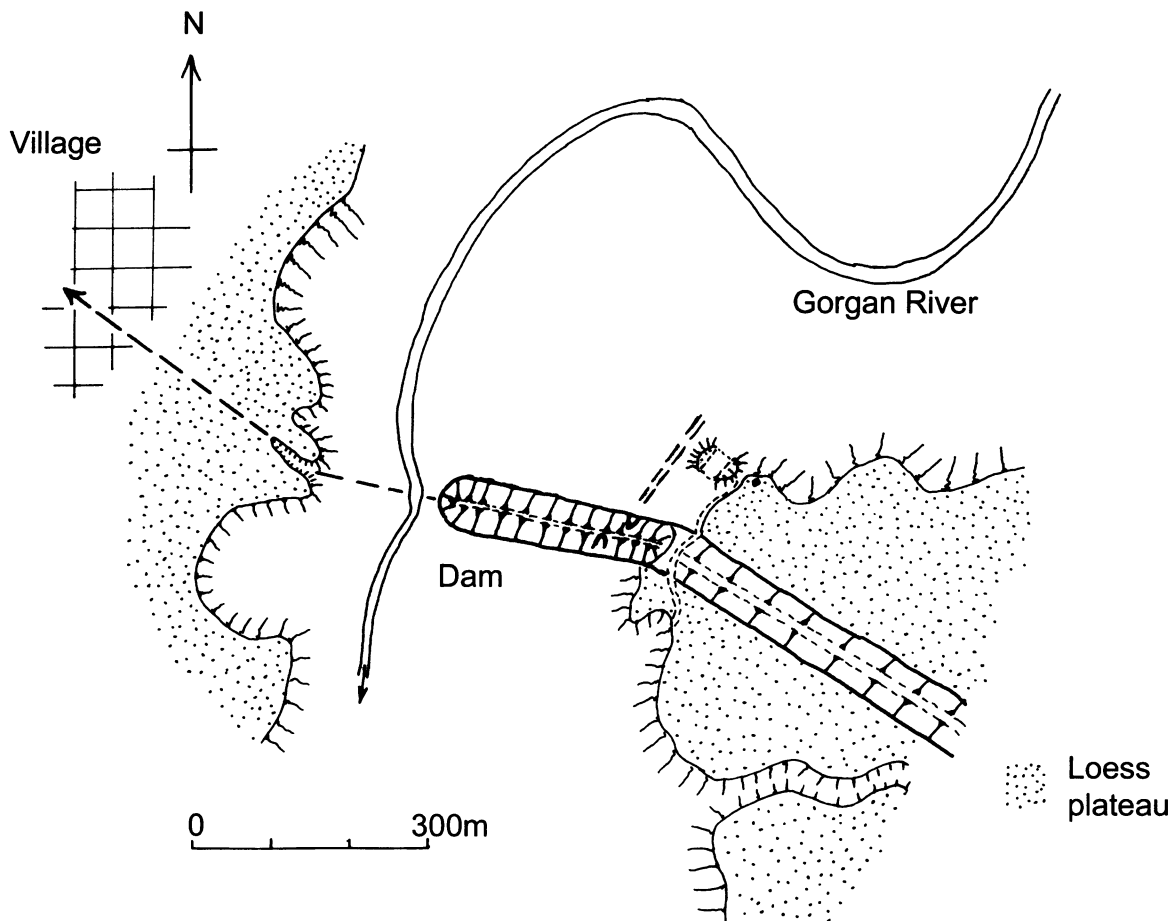


Fig. 18. Plan of the Sadd-i Garkaz Dam by TW. The division between the high and low dams is at the bend in the dam.

be rather different. The eastern Chai Ghushan Kuchek (Fig. 17) could be readily followed from a gully eroded in the loess terrace (opposite a large earthen dam, Fig. 18) to its junction with the Gorgan Wall, but its course was less distinct and its morphology more subdued than the other two canals. Nevertheless, it was again characterised by low upcast mounds, the more prominent feature being on the western bank. As with the other two canals, this feature joined the Gorgan Wall ditch via a gap in the wall, although the relationship between canal and ditch was less clear than in the other two canals.

A remarkable feature of the Chai Ghushan Kuchek canal was that at its terminal end it led directly towards a massive earthen dam that had been constructed to block the c. 20 m. deep valley of the Gorgan River (Fig. 18). This dam (Sadd-i Garkaz) (Nokandeh 1999: 55–56, figs. 171–76), was of triangular section, and comprised a western high dam c. 300 m. long, which had apparently

dammed the Gorgan River Valley up to approximately the level of the loess plateau (Fig. 18), and a supplementary low dam, which extended a further 400 m. to the east in order presumably to intercept any flow that might have attained the level of the loess plateau to the east (Fig. 19). This expedient appears to be because the loess plateau immediately to the east of the river was some 3 m. lower than that to the west through which the canal had been cut. The western end of the dam, at the point where the present course of the Gorgan River flows, has been breached by the river, and immediately opposite the dam, where the canal would have been expected, a gully has been eroded into the loess plateau (Fig. 18) thereby destroying the actual junction point of the canal with the dam. Upstream of the dam and to the east, a low channel-like depression appears to have functioned to channel surplus flow downstream and below the dam. Significantly, this subdued feature had not been obscured



*Fig. 19. The 700 m. long Sadd-i Garkaz dam.*

by sediments, neither was there any sign that there had been any significant sedimentation upstream of the dam at all. The presence of a sedimentary accumulation upstream is the hallmark of most long-lived and successful dams, thus it appears that although the dam is quite clearly an ancient feature, it must have been breached in antiquity, presumably after a relatively brief period of use.

The earthen dam was constructed of a sandy silt loam containing rare pebbles and occasional small molluscs; weak tip-lines could be discerned parallel to the slope on the south side (downstream) near the river. Fragments of fired brick, of similar type to those used in the construction of the Gorgan Wall, were found in the base of the dam fill near where the eroded face of the dam had been cut by the river, and additional fired bricks had been recorded in the river during previous visits by Hamid Omrani and Jebrael Nokhandeh.

The Sadd-i Garkaz must have blocked the course of the Gorgan River, thereby impounding a reservoir upstream so that the water was able to reach the level of the Chai Gushan Kuchek canal. This then formed the conduit through which water entered the Gorgan Wall ditch. Although no similar dams were associated with the other two canals, such dams could have been entirely eroded away by the dynamic and powerful flow of the Gorgan River.

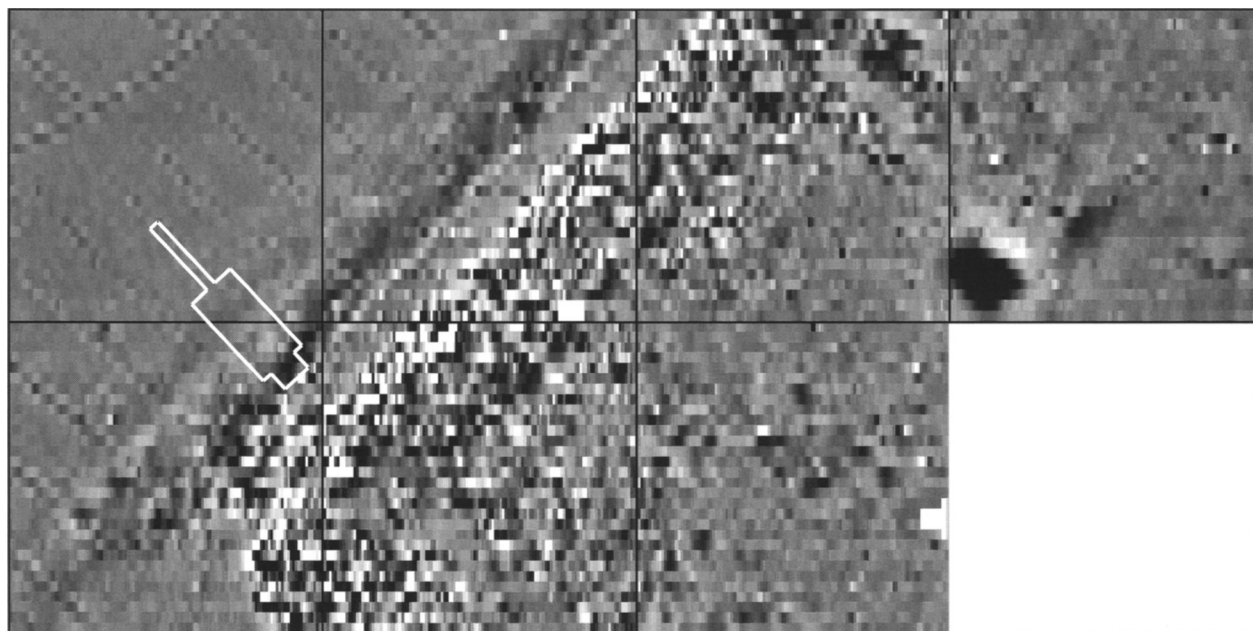
By impounding large, albeit (temporary?) reservoirs upstream, the Sadd-i Garkaz and its off-take canal, Chai Gushan Kuchek, could only tap the upper layers of the accumulated waters. Consequently the coarser sedi-

mentary load of the river, and any associated riverine molluscs, are unlikely to have been transported along the canals into the Gorgan Wall ditch. As a result there would have been no supply of bedload, coarse suspended load, or molluscs to feed into the canal system. This probably accounts for the very fine silt-clay sedimentary fill of the ditch exposed in the excavated trench B at Fort 9 (described in the next section).

#### *The Ditch at Fort 9 (JN, ES, MM and ME)*

Significant parts of the wall are preceded by a ditch thought to be up to 30 m. wide (Kiani 1982b: 16), on the basis of its impressive surviving remains. No section through this major obstacle in front of the wall had, however, ever been recorded. The vicinity of fort 9 was selected for this purpose, as it is located in a particularly wet area, in some places still damp on the surface when we commenced our fieldwork in mid-September (and flooded in winter). We thus hoped that the ditch section would not only shed light on the defensive system and the date of its creation, but might also yield valuable environmental evidence. The vicinity of the fort seemed ideal, as rubbish, including potentially food remains, might have been discarded here. In the absence of certain signs for gates on the enemy/ditch side of the wall forts, there is no obvious area where the garrison would preferentially have discarded their refuse. We assumed, however, that rubbish would most likely cluster in the direction of the natural gradient and water flow (from NE





*Fig. 20. Magnetometer survey of the west-corner of fort 9, by DP, HO, SU and Roger Ainslie (Abingdon Archaeological Geophysics). Each square corresponds to 30 x 30 m. The polygon marks the edges of trench B. The bottom left corner is at 37°18.429'N, 55°13.656'E, the bottom right corner at 37°18.428'N, 55°13.736'E, the upper left corner at 37°18.462'N, 55°13.655'E, and the upper right corner of the northernmost grid at 37°18.461'N, 55°13.735'E.*

to SW in front of fort 9). We thus sectioned the ditch near the west corner of the fort, assuming that a higher concentration of food remains or other lighter rubbish would have accumulated there. A geophysical survey of seven grids was carried out prior to the excavations (Fig. 20). These comprised also an area within the fort. Within living memory the interior of the fort, as well as adjacent sections of the wall to its west, still served as a graveyard. Labelled tombstones, deep pits and a few large mounds, surrounded by circular ditches, remain visible; the latter are, according to local tradition, centuries old. These secondary features made parts of the fort unsuitable for survey. The remains of the NW-facing wall formed a distinct anomaly, but no traces of internal buildings were detected. A band of high magnetisation at the inner edge of the ditch was just *c.* 3 to 4 m. wide.

A trench (B) of 20 m. length and up to 5 m. width for 12 m. in the SE, and 1 m. width for 8 m. in the NW at a right angle to the edge of the fort, revealed that this band appears to have been caused by the collapse of the wall (contexts B.010 and B.004; see Fig. 22). Many of the brick fragments embedded in these deposits were large and the size of the fragments increased towards the bottom. A few bricks, having landed softly on clayey silt

(in context B.013), were completely preserved, while the main collapse of the wall resulted in the breakage of most bricks and their deposition at a variety of angles. The compactness of deposits B.004 and B.010 and high concentration of brick fragments adds strength to our assumption that we are dealing with wall tumble rather than broken fragments discarded when the wall was robbed out.

The magnetometer survey suggests that there may be a particular concentration of magnetic material, probably fired brick, in the ditch section near the fort's western corner. There is no sufficient evidence to offer a certain explanation of this concentration; possibilities include an otherwise unproven corner tower having collapsed, a theory which could be tested by excavation, if enough of the wall and/or tower foundations survive.

Originally, it had been our intention to excavate a complete section through the ditch system, but its massive scale and the limited time available prevented us from completing this task. When it became clear that the ditch was deep, it seemed preferable to reach its bottom (to reveal its scale and to extract samples) rather than to try to section all of the *c.* 33 m. wide modern linear depression, even if it seems likely that the modern





Fig. 21. Trench B: the section through the canals next to fort 9.

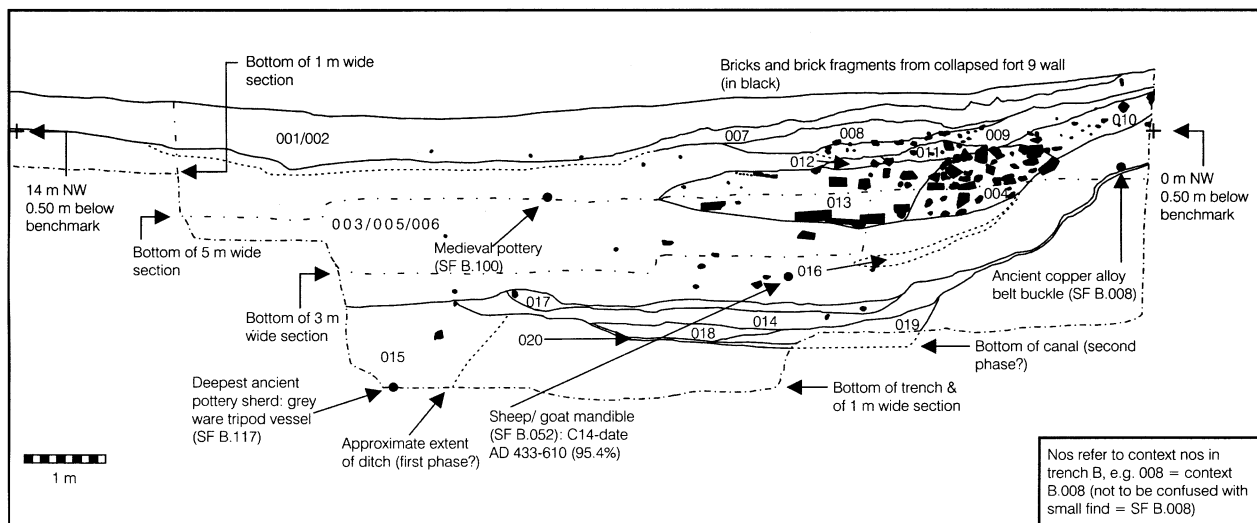


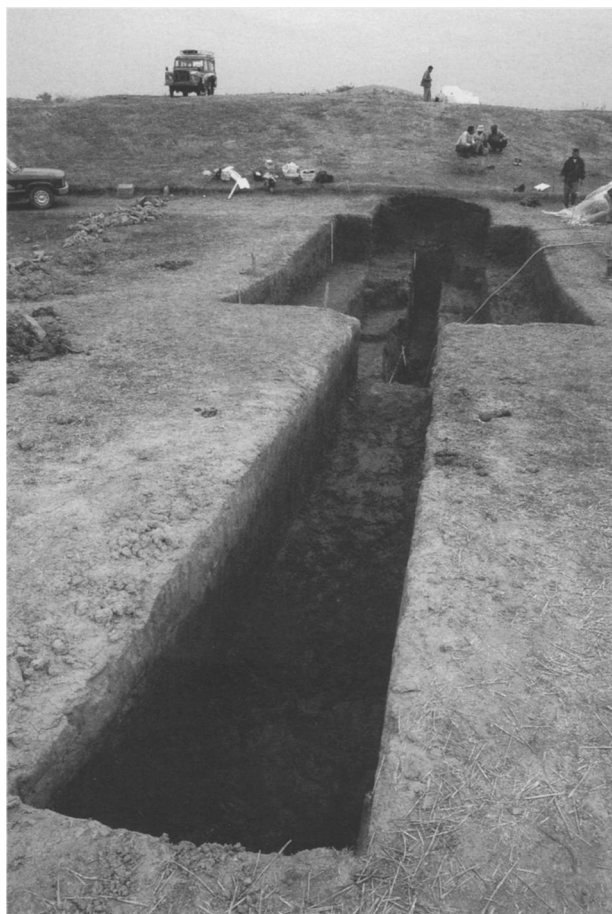
Fig. 22. Trench B: south-west-facing partial section through the canals next to fort 9.

shallow ditch closely reflects the original width of the ditch system. In order to be able to excavate it safely, it had to be stepped (Fig. 21).

Our excavation established that there were at least two consecutive ditches (Fig. 22). As a result of the depth of the stratigraphy, only the shallower of these two could be explored in detail. It reached 3.23 m. below our site benchmark. B.020 formed, for a short period of time, its bottom fill. Deposits B.019 (soft mid-brown clayey silt) and B.018 (soft light-brown silty clay) are similar to the natural soil and indicative of side erosion, while B.014 is suggestive of a reduced speed of erosion and more stable

conditions: the heavy iron-staining of this deposit of mid greenish-brown clayey silt suggests that it formed the bottom of a water-filled canal for some time. On the slope, rising up to the fort platform, B.014 formed a thin band. The water in the canal must have reached or exceeded a depth of 2.10 m. at the time, to judge by the extent of this deposit (from 3.00 to 0.90 m. below the benchmark).

If we assume that the level of the modern land surface, beyond the ditch opposite the fort platform, reflects that of the ancient land surface, then the ditch would have reached some 4.50 m. beneath it, the fort platform, with a height of 3.29 to 3.31 m. above the



*Fig. 23. Trench B: the section through the canals with the platform of fort 9 in the background.*

benchmark at 9 to 12.50 m. SE of the zero-point of trench B, some 2 m. above it. The overall difference in elevation between the preserved fort platform and the bottom of the ditch, irrespective of the level of the ancient land surface, was no less than 6.54 m. (Fig. 23).

The trench revealed 7.90 m. of the width of the ditch. The absence of any trace of a slope opposite the fort platform, except for its lowest part, however, suggests strongly that it went beyond the north-western limits of the deeper sections of our trench. The water-filled ditch served multiple functions: it would have formed a defensive ditch of extraordinary dimensions, as well as carrying substantial quantities of water for irrigation and brick production (and maybe temporarily also transport via towing-barges?). The soil profile and iron staining suggest that it may have done so only for a limited period of time. The low level of sedimentation behind the Sadd-i Garkaz dam, referred to above, may equally point to a rather short-lived system, even if the

period of use of the postulated reservoirs associated with the Aghabad canal (and the Sarl-i Maktoom further downstream from fort 9) remains unknown.

During the excavations of trench B, the water table was just 0.98 m. below the benchmark, but this was most probably the result of modern irrigation of nearby fields; no perishable ancient organic matter survived anywhere in the trench. Most probably the ground water was low in all periods without artificial water supply. The iron staining in B.017, B.014 and B.019 suggests that the ditch dried up and that the water level at the time was below the bottom of the ditch. This happened probably when it was no longer fed with water from the Gorgan River, conceivably as a result of a dam in the valley having burst or (less probably) a supply canal having silted up.

Yet, despite its impressive dimensions, this was not the deepest ditch. Some 7.90 m. to 9.87 m. north-west of the south-eastern edge of the trench end we encountered, underneath it, a deeper ditch (filled by deposit B.015). No clear edge was visible, but this need not surprise. In this environment dry and sterile ditch fills are often indistinguishable from the natural loess. They often consist largely of redeposited natural soil. The same is true for much of the fill of the shallower ditch: contexts B.003, B.005 and B.006 were virtually indistinguishable from one another, and were distinguishable from the natural solely by embedded artefacts and their stratigraphic relation to the distinct deposits at the bottom of the ditch and the side facing the fort platform. That the deposit in question (B.015), the postulated fill of a deeper ditch, was not of a geological age either is shown by the inclusion of fired brick fragments of up to 7 cm. maximum diameter and of the foot of a grey ware tripod vessel (Fig. 24; small find B.117), first thought to be of Parthian date (see Kiani 1982b: 25, fig. 18 for a similar vessel). This sherd was found at the very bottom of our trench, still firmly embedded in its matrix, 9.37 m. north of the south-eastern trench end and 3.70 m. below the site benchmark. We thus can be certain that this ditch was at the very least 0.47 m. deeper than its shallower counterpart, and conceivably substantially more. It is not entirely beyond possibility that this canal is much older than the wall or that the sherd was redeposited centuries after its manufacture. Yet, it seems more likely, given how little is known about local pottery chronology, that it ought to be re-evaluated in the light of the scientific dates and that the sherd thus should be attributed to the late Sasanian period. Further excavation is needed to establish the width of the ditch, but it seems probable that either this ditch, or a sequence of ditches, accounts for

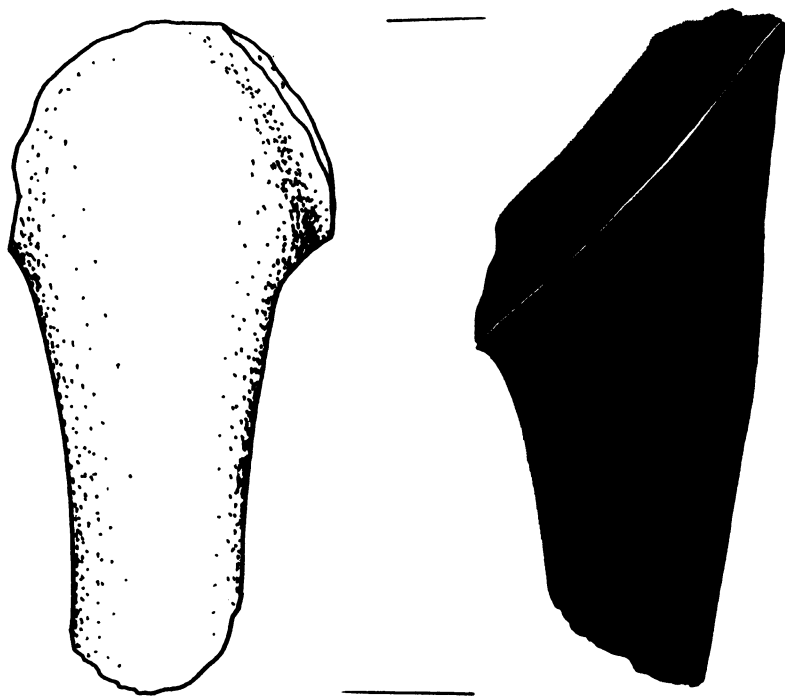


Fig. 24. Foot of a grey ware tripod vessel (small find B.117), drawn by Mohaddeseh Mansouri Razi. Scale: 1:1.

the modern linear depression which extends to *c.* 33 m. overall width.

As we did not reach the bottom of this early ditch, we cannot be certain whether or not it carried water. Snail shell fragments from B.015 appear to be of land snails (Professor Mark Robinson, pers. comment), but it ought to be born in mind that B.015 is not the bottom fill of the ditch and probably built up as a result of side erosion. It is perfectly conceivable that this ditch, like its shallower counterpart, served as a multi-purpose water canal. Indeed, its depth and distance from the fort platform renders it likely that we are dealing with a substantial irrigation canal, rather than a purely defensive dry ditch. The three canals connecting the ditch outside the Gorgan Wall with the Gorgan River (referred to above), suggest that the water supply system underwent various phases of repair and usage, probably involving at least three large reservoirs and supply canals, referred to above, two of them upstream of fort 9. Since all three used water from the same river, it is unlikely that they are contemporary. It is perfectly possible also that the canal in front of the wall had to be redug on one or more occasion(s), after its predecessor(s) had silted up. The presence of fired brick fragments in deposit B.015 suggests that at least the silting up of the upper fill of this ditch postdates the building of the Gorgan Wall.

There can be no serious doubt that contexts B.020, B.019, B.018 and B.014 formed the successive bottom

fills of a ditch, nor that B.015 is the fill of a manmade feature as well, most probably a second ditch (even if the small part excavated showed no evidence, unlike the former ditch, of it carrying water at this level). The relative sequence of these two ditches is, however, not entirely certain. The artefact distribution in B.015 and its stratigraphic relation to B.014 suggest that it was cut by the shallower ditch. However, as the precise location of the context boundary of B.015 in the SE is hypothetical (its soil being virtually indistinguishable from the natural, but, unlike the natural in the SE of the trench, containing artefacts) and B.014 was least well-defined in the NW, this postulated stratigraphic sequence is not proven beyond doubt. Indeed, B.014 appears to be truncated at a low level in the NW. Possible explanation include that the ditch, filled by B.015, cuts B.014 and is thus later than the shallower ditch after all—or that B.014 is cut by a later unrecognised feature filled with redeposited loess, indistinguishable from the material it was cut into. In summary: it cannot be decided with certainty whether the deeper or the shallower ditch is more ancient, even if our observations suggest that the deeper ditch is probably cut by, and thus older than, the shallower ditch.

We cannot be entirely certain either whether the creation of the earliest ditch predates or postdates that of the wall, but one would be inclined to think that it is contemporary, and the spoil extracted from the ditch was used to create the fort platform and may have been used

as raw material for bricks; once functional, the canal may have provided the water needed for brick production and irrigation. It is interesting to note that, also, in the Merv Oasis Partho-Sasanian forts were frequently located adjacent to canals (Bader *et al.* 1992 and 1994; Cerasetti and Tosi 2005: 103), which equally provided water for irrigation and brick production. In Sasanian Mesopotamia, as in case of the Gorgan Wall, canals served not only the purposes of irrigation (and brick production), but also of defence (Howard-Johnston 1995: 190–91).

*Downstream areas around Qizlár Qaleh*  
(TW, JN and HO)

Typically canal systems can be divided into three zones, a) an upstream water collection zone, b) a middle water transmission zone and c) a downstream area where water is distributed over the land for purposes of irrigation. Although it is not yet clear what the canals and associated Gorgan Wall ditch were for, irrigation represents an obvious function. That it may have been constructed for

irrigation further to the west is supported, first by the presence of apparent channel branches downstream and to the west, and second by the occurrence of what appear to be canals in the area of the site of Qizlár Qaleh.

The possibility that water was distributed from the Gorgan Wall ditch is raised by the evidence from the map of the Gorgan Wall which indicates what appear to be branch canals by fort 23 and fort 29 (Kiani 1982b: figs. 6–8a). Although these features are not described in the text of Kiani, they resemble canals, and after they branched off from the main wall/ditch they follow the hydraulic grade of the terrain, and could readily have been used to supply water for the main archaeological sites downstream and to the west as well as their fields. Unfortunately both branches are ambiguous. The branch near Fort 23 is adjacent to a relict channel of the Gorgan River and it is possible that water was derived direct from dams on the main river, as was the case further upstream, rather than diverting it from the Gorgan Wall ditch. In the case of the branch at Fort 29, although the river is much further away, the bifurcation on Kiani's map could be reinterpreted as connecting with another relict canal-like feature a little to the south.

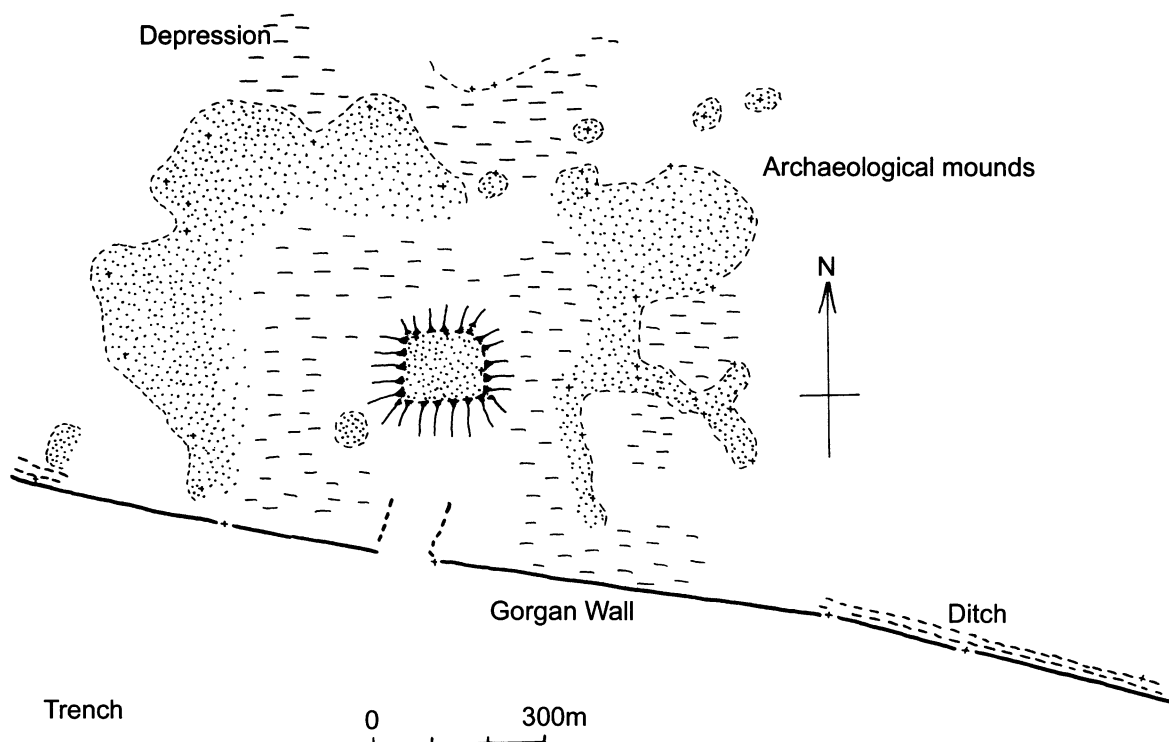


Fig. 25. Field sketch plan of Qizlár Qaleh and the neighbouring part of the Gorgan Wall by TW (cf. Fig. 2).



Because of ambiguities in the interpretation of what appear to be maps traced from air photos, it was essential to try to obtain some degree of ground truth either for individual features or more generally for evidence of canals. In addition, reconnaissance survey was undertaken to check the dimensions of at least one of the sites in order to ascertain its true size.

The area chosen for field checking was around Qizlár Qaleh where a recognisable ditch was parallel to and north of the Gorgan Wall (Fig. 25). In addition, canal-like features were recorded in a long, *c.* 2 m. deep, machine cut, dug for no obvious purpose across the plain some 500 m. to the SW of Qizlár Qaleh<sup>5</sup> and a similar distance south of the Gorgan Wall ditch. The most well-defined feature (WP 091), which was visible in both walls of the cut, was *c.* 9 m. in width and 1.4 m. deep. The fills consisted of olive greenish grey silty clay, mottled, with 1–2 sherds of uncertain date. The overlying fills contained occasional bivalve shells, and the feature itself was cut into a brown loamy sand layer, possibly the deposit of a former Caspian Sea transgression,<sup>6</sup> overlain by a well developed blocky clay loam palaeosol developed over the sandy possible transgression layer.

Not only did the fills resemble those of the Gorgan ditch, they revealed evidence of water logging and sluggish flow. The contained pottery demonstrated clearly that the feature was associated with human activity, and because it is quite normal to recover pottery from canals, it is likely that the feature is indeed a canal, perhaps a feature represented by a broken line on the map of Kiani (1982b: fig. 8a).

Although more field evidence would be required to support the interpretation that the Gorgan Wall ditch supplied an irrigation system in the area of Qizlár Qaleh, it appears likely that these large sites on the western plain were apparently associated with a water distribution system.

A conspicuous feature of the Gorgan Wall is that rather than following a circuitous path to bound and protect all the significant sites on the plain, it followed a curvilinear path down the hydraulic grade of the plain, approximately parallel to the Gorgan River. A number of sites of various sizes were evident to the north, and apparently beyond its protection. Because most appear to have included at least some Partho-Sasanian occupation (Kiani 1982b), it will ultimately be necessary to establish whether they were recipients of water from any putative channel system associated with the wall, how large they were, and whether they might

have benefited from irrigation to increase yields and enhance the food supply. Conversely, if large sites were to be found north of the wall, were they of the same date as the wall, and therefore marooned outside its protective bounds?

At Qizlár Qaleh although the main fortified mound was only a few hectares in area, Kiani's map of this site (Kiani 1982b: fig. 8a: "Qarniaregh Q.") implies that it was surrounded by a much more extensive area of settlement. Figure 25 shows the main Qaleh area (in centre with hachures) surrounded by flat areas of plain, or slight depressions, as well as a surrounding area of low, complex archaeological mounding beyond. The approximate limit of these mounds was sketched and fixed using a hand-held GPS unit. Overall the settlement was demonstrated to extend over an area of approximately 1100 m. E-W by 700 m. N-S. Although this represents a total area of some 70 ha., occupation was not continuous. For example, the surrounding flat plains may have either formed pits for the excavation of mud brick, or perhaps more likely, open areas for the stalling or herding of animals. It was difficult to trace the path of the Gorgan Wall ditch in the immediate vicinity of the site, but it remains possible that part of the water supply for the site came from it.

#### *Hydraulic features: conclusion and interpretations (TW, JN and HO)*

No firm conclusions can be made after such a brief field season, but the clear archaeological relationship between the cross canals, the earthen dam of Sadd-i Garkaz, the ditch and the Gorgan Wall itself, suggests that the entire suite of features might have been conceived as one single system, although its construction appears to have taken place in phases. Moreover, the close functional association between these features suggests that the construction and layout of the wall was constrained by its relationship with the systems of water supply, and the need for the water to follow an alignment that followed the hydraulic grade. Thus the general configuration of the wall suggests that it was a composite feature which appears to have combined both defensive considerations and water supply in its overall layout.

The presence of the above-mentioned relict canals in the construction trench near Qizlár Qaleh, as well as two branch canals to the east, is significant because this is the region where the wall deviates from its normal pattern of



Fig. 26. *Qizlár Qaleh* seen from the vicinity of the Gorgan Wall.

forming the divide between the cultivated plains to the south and the semi-arid steppe to the north. Here, a saline steppe given over to grazing, waste land and occasional wheat cultivation (Unit 64 of the land resources map: Ministry of Agriculture 1968) occurs both north and south of the wall. Such land might, during the Sasanian period, have benefited from the construction of water distribution canals such as those noted above.

Together the Gorgan Wall and its associated hydraulic works represent a massive feat of engineering. Overall it compares favourably with the massive engineering features conceived and built by the Sasanian kings such as the Nahrawan canal (Iraq), the Mashruqan channel (near Shushtar, Iran) as well as other major canals of SW Iran (Wenke 1975–76), all of which combine massive scale, technical sophistication and the mobilisation of huge labour forces.

In addition to its function as a defensive feature the Gorgan Wall ditch could have been used to supply water for irrigation further downstream. However, the accumulated sediments suggest that the flow rate of the water was sluggish, at best, therefore as a supplier of water for irrigation it may have been relatively inefficient. Moreover, the entire system can only have functioned when the reservoir(s) were full. The earthen dams were extremely vulnerable to the powerful floods of the Gorgan River, with the result that flow would have been interrupted frequently so that the system as a whole would have been rather unsustainable. It also seems likely that the ditch was excavated to supply clay

for the manufacture of bricks for the wall, and also to conduct water to the point where it was required in order to obviate the need to dig deep wells in this semi-arid area.<sup>7</sup> These combined functions: as a supplier of irrigation water, a defensive feature and a means of enabling baked bricks to be manufactured with greater efficiency, makes the Gorgan Wall ditch a feature of remarkable sophistication.

#### *Geophysical survey at Qizlár Qaleh* (JN, ES, SU, HO and DP)

Qizlár Qaleh (the tepe discussed above), rises some 16.50 m. over the surrounding plain (Fig. 26). It is unique, in being located north of the wall, to have been incorporated into the defensive system and thus of particular interest to our project. Two walls link it to the Great Wall, as is impressively shown by an aerial photograph, published by Kiani (1982b: pl. 11,2, fig. 8a). The western of the two walls, as well as the Great Wall further west and parts of the tepe (including “2003 trench A” on Fig. 27), had been explored by trial trenches by Jebrael Nokandeh in 2003 (Nokandeh *et al.* 2005b: 95–232). They were found to be heavily robbed, a conclusion confirmed by inspection on the ground and geophysical survey.

Various linear anomalies are discernible on the top of the Qaleh, some forming parallel double lines (Fig. 27), conceivably associated with defences of an earlier period. There is nothing to suggest that the defences or

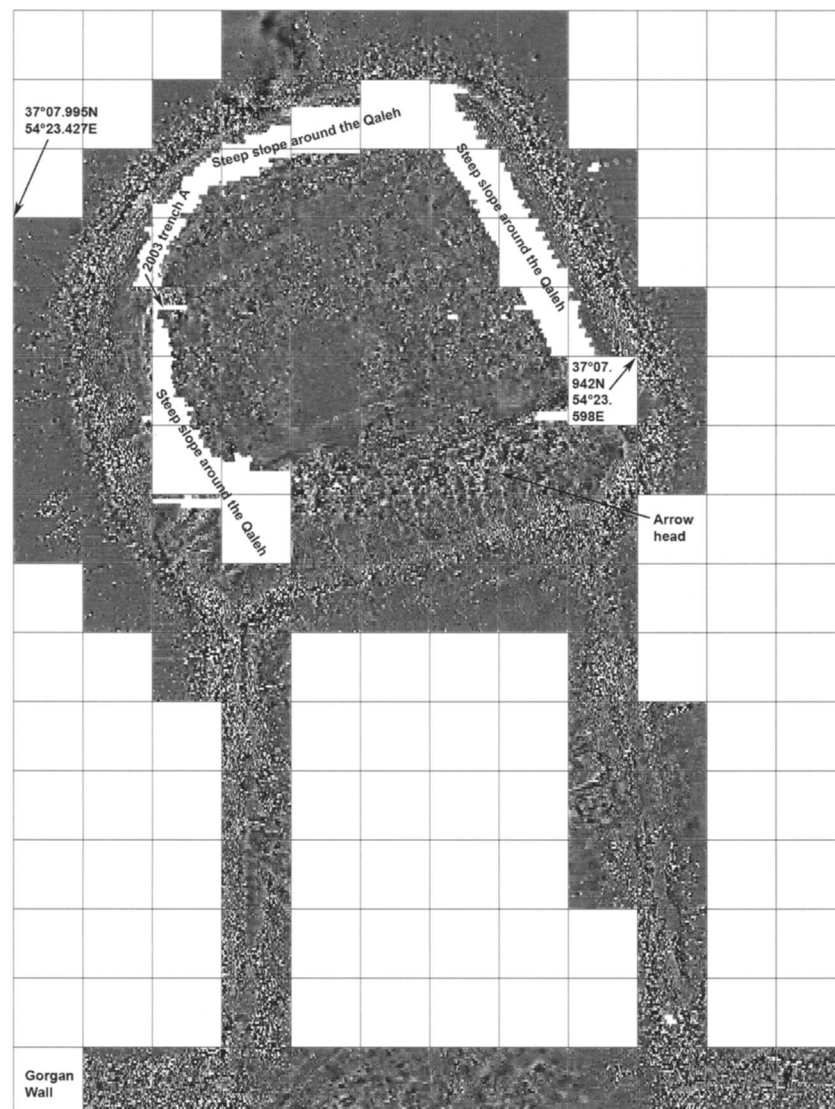


Fig. 27. Magnetometer survey of Qizlár Qaleh, by SU, HO, DP and Roger Ainslie (Abingdon Archaeological Geophysics). Each square corresponds to 30 x 30 m.

any large structures in the interior consisted mainly of burnt brick, even if excavation and surface scatter suggest that a few fired bricks were used here and there.

The magnetometer survey detected high linear anomalies along the walls linking the Great Wall with the Qaleh. Interestingly, there are no high magnetic readings in the alignment of the Great Wall between these two junction walls at all. This suggests that either the Qaleh was included in the defensive system from the start, via a loop-shaped extension to the north, and the Great Wall never built between the start and end point of the loop, or that it was, following or during a later inclusion of the Qaleh in the defensive system, systematically robbed

out. To our surprise, a high magnetic anomaly appears to surround the Qaleh at the bottom of the slope. This anomaly partially overlaps with a scatter of brick fragments at the bottom of the slope. Especially in the north-east, the brick fragments form a distinct band, even if in places the anomaly extends well beyond the modern brick scatter; this may be the result of the build-up of recent alluvial deposits at the bottom of the slope. The brick scatter suggests that we are probably not dealing with a silted-up ditch filled with magnetic material. It is worth noting that there are comparatively few fired brick fragments from the top of the Qaleh and the higher slope (except for the southern side), but a dense cluster at the



bottom of the slope. By contrast, the scatter of the pottery sherds over the top of the Qaleh and the upper and lower parts of the slope seems much more even. These observations suggest that we are not dealing with the collapsed remains of a fired brick wall at the edge of the plateau. Furthermore, it seems unlikely that such a remarkably regular anomaly could have formed at the bottom of a steep slope as a result of the collapse of a brick wall far above. A robbed-out fired-brick wall near the bottom of the slope seems the most likely interpretation of the anomaly, even if the possibility of the remains of a collapsed structure accumulating at the bottom of the slope cannot be entirely excluded.

This high linear anomaly is some 20 m. wide on average, but it seems likely that this includes tumble spread as a result of collapse and robbing. In places the highest readings form a band of some 10 m. width, and it is possible that foundations may survive here *in situ*. The position of a defensive wall at the bottom of a steep slope, if this is the correct interpretation of the anomaly, is unusual. However, since much of the remainder of the Great Wall was located in flat terrain, it would not have formed a weak point in the defensive system. There thus appear to have been two lines of defence; the remains of a second, a 2.20 m. wide mud brick wall at the edge of the plateau, have been found in trench A (not to be confused with this season's trench A) during excavations in 2003 (Fig. 27; Nokandeh *et al.* 2005b: 169, 178).

Interestingly, a wide linear depression (filled partially with water when the site was revisited in

November 2005) surrounds the Qaleh in the east, north and west. Further fieldwork is required to test whether this could be a silted-up section of the ancient main water canal following the Gorgan Wall and whether one of the functions of the postulated brick wall at the bottom of the Qaleh was to reduce the risk of erosion.

While forming a less distinct anomaly than the loop, there is also a high linear anomaly at the bottom of the south side of the slope. If this has been caused by the remains of a wall as well, rather than rubble accumulation at the bottom of the slope, then there were two concentric wall circuits around the tepe, one at the top and one at the bottom, a hypothesis, which could easily be tested by excavation. This may suggest a desire to be able to defend the Qaleh, even if enemies had broken through the wall nearby and that it may have housed a garrison like the forts on the wall. If so, it filled the gap between forts 29 and 30, which are unusually far apart. There are no traces on the plot of a gate or access route connecting the loop-shaped extension of the wall with the extensive extramural settlement beyond. We do not know whether this indicates that the substantial area of settlement immediately outside the loop was (temporarily?) unoccupied at the time, whether the wall separated the community or whether the remains of any gate, bridge and access route are obscured by rubble spread or too faint to be detectable by magnetometer survey.

A single surface find deserves a brief discussion: a three-winged barbed arrow head with a cylindrical socket, made of bronze (Fig. 28), was found by SU at

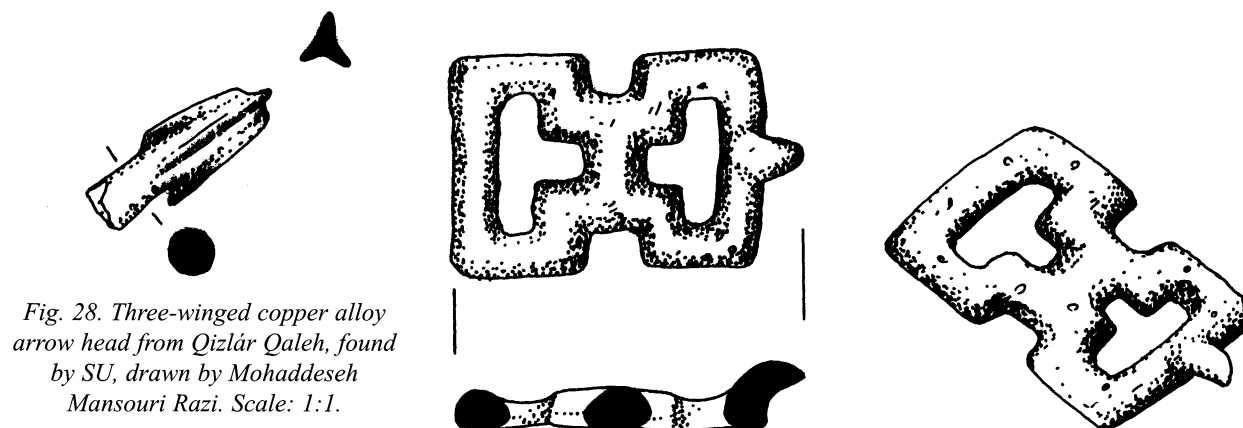
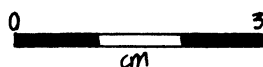


Fig. 28. Three-winged copper alloy arrow head from Qizlār Qaleh, found by SU, drawn by Mohaddeseh Mansouri Razi. Scale: 1:1.

Fig. 29. Copper alloy buckle (small find no. B.008), drawn by Mohaddeseh Mansouri Razi. Scale: 1:1.





the bottom of the slope SE of the Qaleh (c. 210 m. east and 279 m. north of the south-western corner of our 360 x 480 m. magnetometer plot). It may date to the Achaemenid period (Cleuziou 1977: 189, 197), but similar specimens still occur in much later contexts (Boucharlet and Lecomte 1987: 174, 182–83, pl. 101.4).

#### *The garrison of the Gorgan Wall forts*

(JN, ES, MM and ME)

A sizeable assemblage of bones, including goat/sheep, cattle and equids (Julie Hamilton, pers. comm.), and pottery was recovered from trench B next to fort 9. The three-dimensional position of 63 sherds and 41 bones, or clusters of bone fragments, has been recorded. A detailed study of these finds, which promise to shed significant light on local pottery chronology, diet and, possibly, slaughtering practices, is envisaged. Interestingly, with the exception of a single piece of pottery from context B.018, the bottom fill of the later ditch (i.e. deposits B.014 and below) proved to be sterile, while finds were widely dispersed in the middle ditch fill (deposits B.003, B.005 and B.006) from 2.54 m. below the site benchmark upwards; a particular concentration of bones and some pottery was sealed well beneath B.010, B.004 and B.013, and these finds must have found their way into the ditch well before the collapse of the wall. This suggests that the ditch was kept clean while it was still carrying water, but that a limited amount of rubbish was deposited, probably by a late garrison or other late occupants of the fort, in what was now a dry and slightly shallower ditch. One of the bones, to be discussed below, has been radiocarbon-dated.

The most unusual artefact from trench B was a copper alloy buckle (Fig. 29; small find no. B.008), for a thin belt or girdle. Sealed well beneath the wall tumble in context B.006, c. 0.40 m. NW and 0.95 m. below the site benchmark (see Fig. 22), i.e. just around 7 cm. above the natural, on the upper slope of the ditch, its findspot suggests that it was dropped from the top of the wall or from the berm into the ditch. It thus seems reasonable to assume that it was lost by a member of the fort's garrison, not too long after this canal had been dug. Its design, notably the position of the hook, bears some resemblance to other open-work frame buckles, notably a few much more elaborate specimens from the antiquities trade, maybe found near Kerman. The latter, the best parallels known to us, but by no means identical

or necessarily contemporary are, mainly on stylistic grounds, thought to be Parthian (Ghirshman 1979: 170–76, 188–91, pls. I–III; James 2004: 249–50, cf. 76–77 no. 39; Collon 1995: 194–95 with fig. 159). The scientific dates for the wall, to be discussed below, suggest, however, that our specimen was a late Sasanian dress or equipment accessory.

The quantity of refuse from this ditch section, as well as the dense surface scatter of artefacts within the Gorgan Wall forts, is a powerful argument against them being just temporarily occupied. There is in any case little doubt that the defensive system was designed for a strong and permanent garrison; 36 forts, spread over almost 200 km., could hardly have been manned in time, with a sufficiently large and experienced garrison, in response to intelligence of an imminent attack by the Empire's fast and mobile northern neighbours. That the few burials excavated by Kiani (1982b: 36) have yielded arrowheads adds further possible circumstantial evidence for the presence of a military garrison on the wall, no matter whether the arrows were grave goods or had caused the death of the individuals. There is little doubt that bow and arrow were the main long-range weapon on the wall, and will have been used by the wall's defenders as well as well by their northern neighbours. The concentration of forts along a linear barrier and their reasonably regular spacing suggests a professional garrison (rather than emergency retreats for the civilian population and their livestock in times of crisis). While for many other Sasanian forts there is no incontrovertible evidence for permanent dense interior occupation either, this may well be in part due to the scarcity of excavations. Better-explored forts, such as Tureng Tepe (Boucharlat and Lecomte 1987) and Siraf (Whitehouse 1972: 69–70) were densely occupied, and Kiani's excavations (1982b: 19–20) leave little doubt that this equally applied to the Gorgan Wall forts.

#### *The Wall of Tammishe (JN, ES and HO)*

The Wall of Tammishe runs from the south-east corner of the Caspian Sea into the foothills of the Elburz Mountains (Fig. 2). It was first explored through excavation and survey in 1964 (Bivar and Fehérvári 1966), when, mainly on historical grounds, a 6th-century A.D. date had been suggested for the construction of this monument (Bivar and Fehérvári 1966: esp. 47). It was surveyed again in 2001 (Nokandeh *et al.*

2002). The latter project, whose underwater archaeologists were directed by Hossein Tofiqian (Nokandeh *et al.* 2002: 17, 50, 52; Anon. 2006), has been able to trace a probable northern continuation of the Wall of Tammishe and an additional fort on the floor of the Caspian Sea on the basis of the discovery of brick fragments from the sea floor. The area of the probable fort is raised and has been known as Khesht Pol ("Bridge of Bricks") or Khesht Sar ("Place of Bricks") amongst local fishermen and bird hunters who report that it formed an island about twenty years prior to our visit, when the water level had been low. During a brief boat visit to the postulated site of the fort and a brief diving expedition (by SU) on 30 September 2005, a GPS measurement for its location (36°48.595' north and 54°01.234' east) was taken and the Caspian Sea at this spot found to be *c.* 2.55 m. deep.

The Wall of Tammishe is significantly shorter than the Gorgan Wall, due to the close proximity of the mountains to the sea in this area. A dense brick scatter reveals that, after reaching the foot of the mountains, the wall leads up a steep slope in the forest and terminates at an artificial mound, thought to contain the remains of a fortlet or watchtower, at 36°43.360' north and 54°03.675' east. The distance from here to the above-mentioned probable fort in the Caspian Sea (the "Bridge of Bricks") amounts to *c.* 10.3 km., as the crow flies; the length of the wall, not following an entirely straight course, would have exceeded this. The defensive ditch to the west of the wall, however, continues well beyond the mound, following a natural ridge into the Elburz Mountains to 36°42.625' north and 54°04.080' east over an additional 1.5 km., as the crow flies. It seems possible that the brick wall was replaced by defences consisting of locally

available soil and timber. Near the southern terminal of a ditch a probably artificial earth bank survives, which would merit further examination. The gradient of the slope would have made it more and more arduous to provide a sufficient quantity of heavy bricks, the further the defences led into the mountains. Excavation is needed to decide whether the ditch in this section was lined by a palisade, an earth bank or a timber-reinforced rampart. Beyond the terminal of the ditch a steep natural ridge continues further into the mountains. A more extensive survey is required to establish whether or not any linear defences recommence further uphill. There is little doubt that the continuation of the barrier into the mountains was designed to make it more difficult to circumvent the defensive line.

Once impressively preserved (Kiani 1982b: pls. 10–11,1), sections of the Tammishe Wall, cutting across fertile land benefiting from orographic precipitation, have been levelled since the 1960s to increase the size of fields; any surviving remains north of the Gorgan-Sari road are now under the tarmac of a modern road. Two well-preserved sections remain, one a short stretch in a field (36°44.337' north and 54°03.593' east), the second, further north, first observed by Bivar and Fehérvári (1966: 40) and described as a "track along the top of which a car may be driven" (Fig. 30). While most of the remainder of the wall has fallen prey to brick quarrying and had to make way for agriculture, this section's secondary function as an elevated driveway has ensured its survival to the present day. Its height at the point where the OSL samples were taken (see below) still reached *c.* 2.79 m. (measured from the base of the lowest of three preserved courses of bricks) (Fig. 31). An inspection of the surviving remains suggests that the wall



Fig. 30. The best-preserved section of the Tammishe Wall.



Fig. 31. The Tammishe Wall surviving to a height of c. 2.79 m. above foundation level: the OSL sample tube for the underlying sediment is visible; another OSL sample was taken from a brick in situ. Each red or white segment of the ranging poles (positioned 2 m. apart) corresponds to 0.50 m. (as on all other photographs).

was faced with a single row of bricks on either side, while the core consisted of earth. A future section of the ditch in the west may thus allow us to calculate how high a wall the extracted soil would have permitted.<sup>8</sup> We do not know whether or not the lower courses of the wall in the forest further south may still be preserved. A magnetometer survey on uneven terrain in the forest yielded no sufficiently clear results.

*The Brick Kiln at the Wall of Tammishe (JN, ES, GA, DP, HO and SU)*

A surface scatter of brick slag revealed the probable position of several brick kilns near the Wall of Tammishe. We carried out a magnetometer survey of nine 30 x 30 m. grids within this area, which revealed six high magnetic anomalies of possibly rectangular

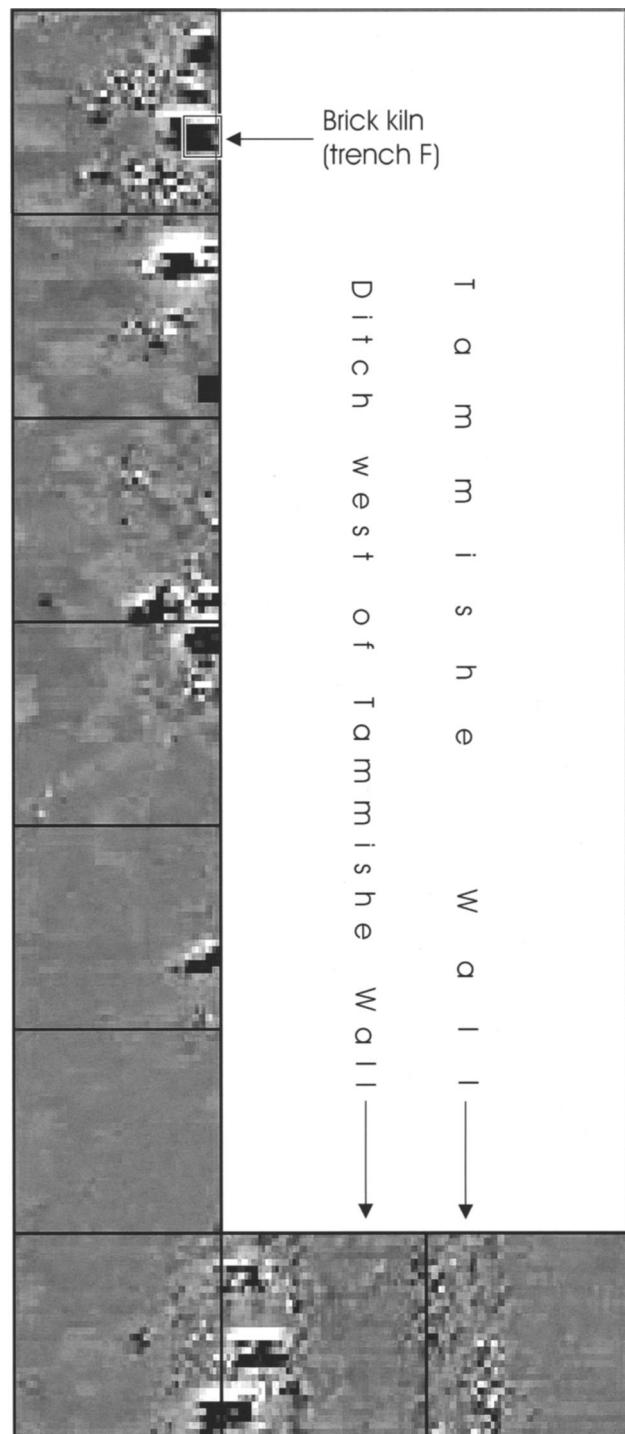
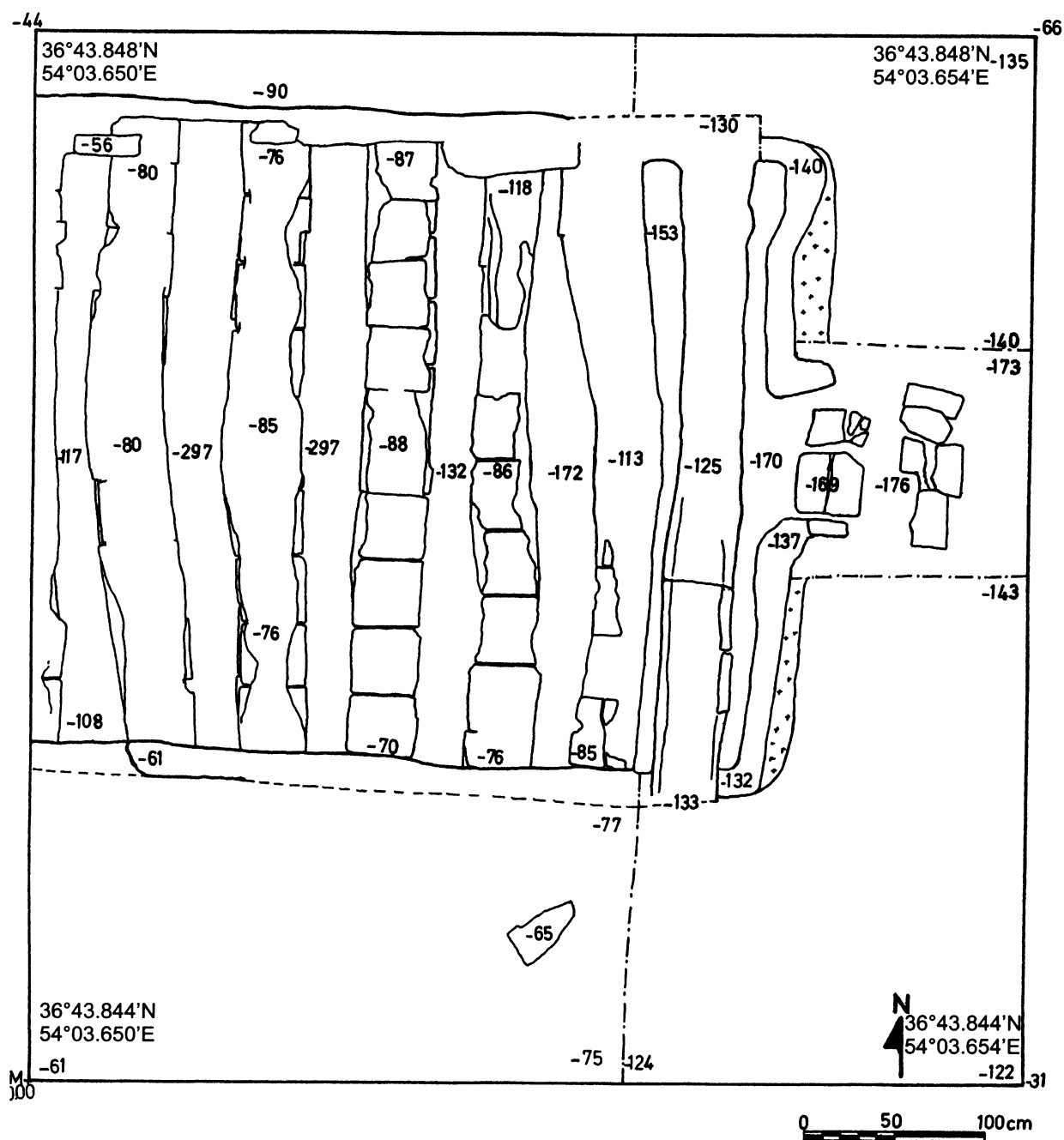


Fig. 32. Magnetometer survey along the Tammishe Wall, by DP, HO and SU with location of trench F. Each square corresponds to 30 x 30 m. The bottom left corner is at 36°43.742'N, 54°03.650'E, the bottom right corner at 36°43.747'N, 54°03.690'E, the upper left corner at 36°43.856'N, 54°03.631'E, and the upper right corner of the northernmost grid at 36°43.858'N, 54°03.652'E.





Plan of brick kiln next to the  
Tammishe Wall (trench F)

The Great Wall of Gorgan Project 2005

Drawn by M. Hussein-Zadeh

Fig. 33. Plan of trench F by Maryam Hussein-Zadeh: a brick kiln next to the Wall of Tammishe. The GPS measurements refer to the corners of the trench, the heights (in cm.) to the benchmark for trench F, set arbitrarily at zero.

shape lined up alongside the wall (Fig. 32). These probably represent brick kilns, and it is possible that the same is true for four weaker or less regular anomalies. All of these anomalies are to the west of the

wall and separated from it by a substantial ditch. While the best-preserved section of this ditch is further north, it survives also in this area as a distinct linear depression, whose lesser depth is probably the result of



modern agriculture and erosion. It may be relevant that the kilns abut the outer edge of the ditch. After rainfall, frequent in this humid area, the ditch, which partially follows natural valleys in the mountains, would probably have carried water. This could have been used for brick-making, e.g. by creating temporary barrages in the ditch. Had the kilns been lined up on the inner side of the ditch, they would have obstructed the construction of the wall, unless built further away from the ditch. One possible explanation for the sheer number and density of the kilns at the foot of the mountains, could be that these kilns produced bricks for the continuation of the wall along the steep mountainous slope nearby.

One of the most distinct of these anomalies was explored by excavation. As in case of the brick kiln at the Gorgan Wall, we confined ourselves to partial excavation in order to improve the conditions for OSL dating. A trench (F) of 5.50 x 6 m. (Figs. 32, 33) was excavated to encompass the eastern parts of the area of high magnetisation. This indeed proved to be a kiln, whose extent coincided almost exactly with the anomaly. As in case of the Gorgan Wall kiln, we opted for partial excavation to preserve parts of the fill *in situ* for OSL sampling. Like its counterpart near the Gorgan Wall (trench A), it was designed to be able to support a heavy stack of bricks during firing. Six crossbars and parts of a seventh were within our trench (Figs. 33, 34). Spaced narrowly, they would have been capable of carrying substantial weight.

The stratigraphy of the fill of the kiln (Fig. 35) differed from that on the Gorgan Wall in trench A. A layer of brick powder and fragments (F.014) overlay the fire-reddened bottom of the kiln. Above it there was a deposit of mid-blackish brown silty clay, rich in charcoal (F.011). In contrast to deposit A.010 at the bottom of the Gorgan Wall brick kiln, an estimated 60% of which consisted of charcoal, the relative concentration, though not necessarily the absolute quantity, of charcoal in F.011 was far lower. The build-up of ceramic debris at the bottom of the kiln suggests that it was used more frequently than the other kiln, though not necessarily over a long period of time (unless the debris in Gorgan Wall kilns had been systematically removed prior to reuse). Assuming the top of the deposit of brick fragments (F.014), in which no charcoal was observed, formed the surface during the last firing of the kiln, then the maximum internal height of the kiln beneath the arches had been reduced from 1.74 to 1.16 m. (as opposed to 1.58 m. in case of the Gorgan Wall kiln). The arches in the kiln appear to have been exposed to more heat than those in the Gorgan Wall kiln. In contrast to the latter (probably made of mortar and not fire-reddened), parts of the bricks and clay of the arched crossbars of the Tammishe Wall kiln in trench F had vitrified, forming numerous stalactites and giving the interior of the kiln an appearance similar to that of a dripstone cave. To what extent the partial vitrification of the arches may be the result of their lowness and to what extent to other potential factors (e.g. the quantity of fuel or the repeated exposure to heat) is unknown.

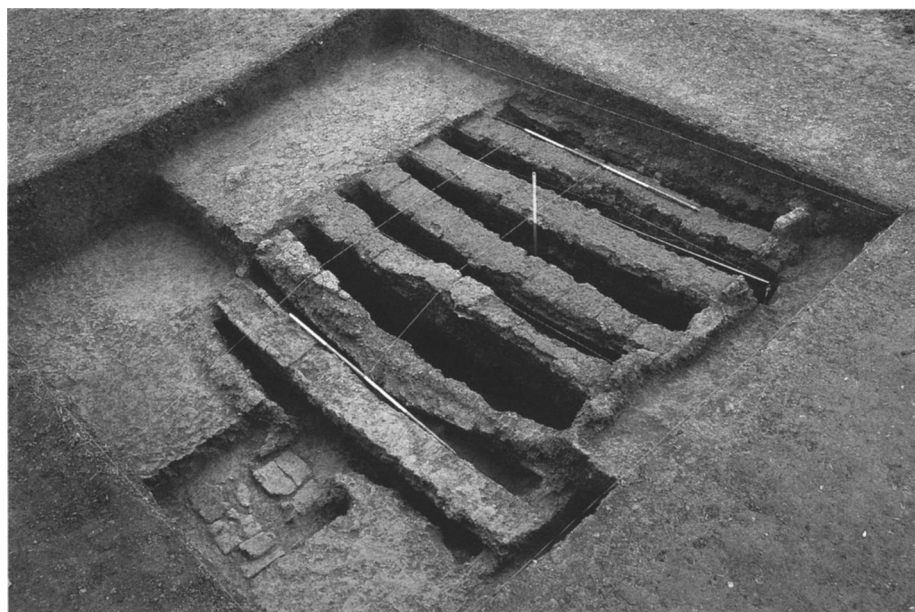


Fig. 34. The partially excavated kiln next to the Tammishe Wall.

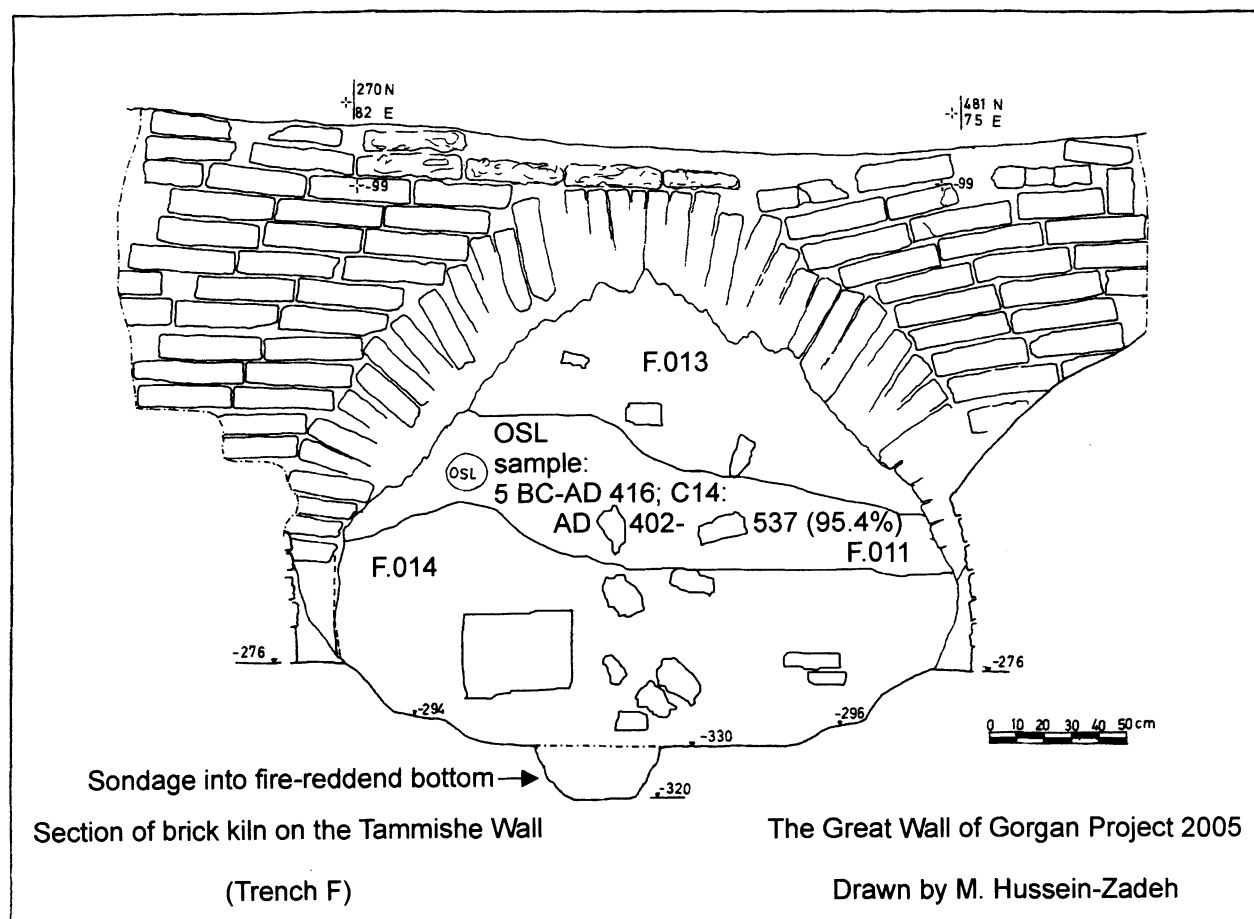


Fig. 35. The east-facing side of the sixth crossbar from the east of the brick kiln next to the Tammishe Wall in trench F by Maryam Hussein-Zadeh. The easting and northing refers to the SW corner of the trench, the heights (in cm.) to the benchmark for trench F, set arbitrarily at zero.

*Geophysical Survey in the Bansaran Fort (JN, ES, DP, HO and SU)*

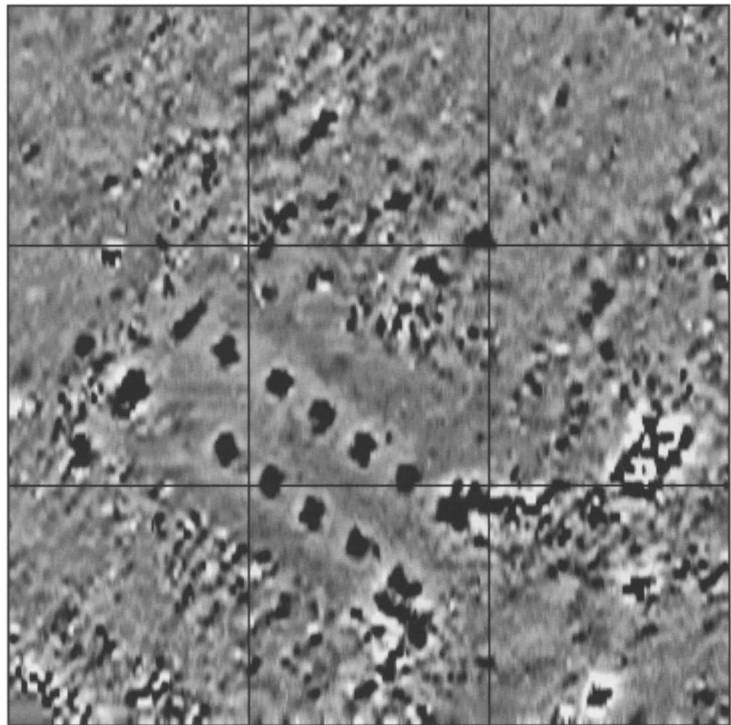
A small-scale magnetometer survey was carried out in the Bansaran fort. In common with the forts along the Gorgan Wall, it is on an artificial platform with straight sides (Fig. 36). This observation and the discovery of a pre-Islamic occupation level in its interior (Bivar and Fehérvári 1966: 44, 46) may indicate that it is roughly contemporary to the Gorgan Wall forts. Being located partially on arable land and partially in the forest, substantial sections of its outer edges still survive as steep slopes, both in the forest and in the arable field. As it is some 500 to 700 m. west of the Wall of Tammishe, i.e. on its outside, if we assume that the ditch to the west of the wall marked originally the enemy-side, we cannot be certain how it relates to the wall and whether or not it originated at precisely the same time. According to Bivar

and Fehérvári's plan (1966: fig. 2) and the more recent survey by Jebrael Nokandeh and colleagues (Nokandeh *et al.* 2002: 49 map 12), it guards the south-western corner of what may be an enclosure, consisting of a series of minor walls west of the Wall of Tammishe, parallel or at a right angle to the main wall. It is thus possible that it formed part of an extension of the defensive system, which also encompassed the town of Tammishe. It was our aim to establish whether geophysical survey had the potential of revealing the interior layout of this fort.

The magnetometer survey of a 90 x 90 m. square (Fig. 37) yielded astonishingly clear results, as did the resistivity survey of one 30 x 30 m.-grid. Several open pits in the forested part of the enclosure (thought by locals to have been dug in search of legendary treasure), as well as a recent trial trench (Nokandeh *et al.* 2002), provide evidence that brick structures had frequently been erected



*Fig. 36. The north-west corner of the Bansaran Fort (looking south-east). The three-aisled structure is slightly further south on the west side of the fort. Like its counterparts on the Gorgan Wall, this fort was on a distinct platform still preserved today. The steep edge of the fort platform is still distinctively visible as an overgrown, almost vertical and up to c. 2 m. high, slope.*



*Fig. 37. Magnetometer survey of three-aisled structure in the Bansaran Fort, by DP, HO, SU and Roger Ainslie (Abingdon Archaeological Geophysics). Each square corresponds to 30 x 30 m. The bottom left corner (just outside the fort) is at 36°44.080'N, 54°03.136'E, the bottom right corner at 36°44.051'N, 54°03.188'E, the upper left corner at 36°44.120'N, 54°03.170'E, and the upper right corner at 36°44.091'N, 54°03.222'E.*

on stone foundations. The common use of both, stone and brick, would explain why structural remains were detectable by both survey techniques. The surveys revealed a large c. 53 x 33 m. three-aisled hall. The regularly spaced high magnetic anomalies separating the central nave from the side aisles must represent the bases of substantial brick pillars carrying the roof. Linear

anomalies, especially to its east, suggest that this three-aisled structure was part of a larger complex. The southernmost pair of bases may have formed part of an entrance porch which was preceded in the south by a forecourt. It is tempting to think that this formed part of a monumental arched entrance whose width corresponds to that of the interior of the hall. The significance of a



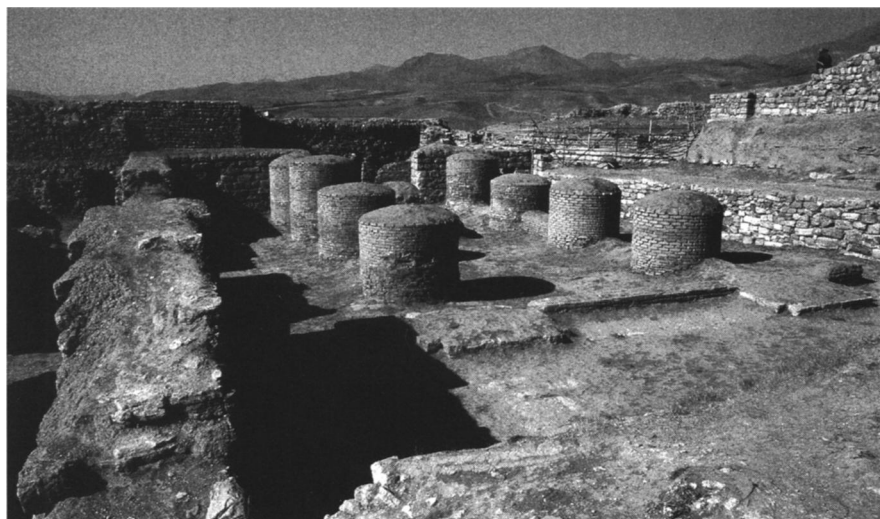


Fig. 38. Brick pillars in the three-aisled Sasanian hall at Tacht-e Suleiman.

rectangular high magnetic anomaly of *c.* 7 x 9 m. to the east of the entrance, which appears to belong to the same complex, is uncertain, but it is possible that it carried parts of the entrance façade. An extension of the geophysical survey to the south-west should reveal whether or not it is mirrored on the opposite side.

The length of this structure of *c.* 53 m. is similar to that of a three-aisled Sasanian hall at Tacht-e Suleiman (Fig. 38) (Huff 1969: 192; Naumann 1977: 57–61, 65), and three-aisled halls occur elsewhere in Sasanian architecture (e.g. Finster and Schmidt 1976: 69–75); it is, however, much wider. It is tempting to associate these remains with the ruins seen in the early 13th century by Ibn Isfandiyār (1,2 = Browne 1905: 16) at Banasran and thought to belong to a legendary palace (Bivar and Fehérvári 1966: 36, 39–40, 47–48). Three-aisled halls, however, occur also in many mosques (Hillenbrand 1994: *passim*, esp. 38), as do monumental entrances. While there is a faint anomaly of possibly semicircular shape, conceivably an apse or mihrab, on the south-west-facing side of the hall, the orientation of the structure (parallel to the fort) does not allow a certain identification of its function. Pottery evidence from the vicinity of our survey area suggests that the Bansaran enclosure was occupied from the Sasanian period to the 15th century (Bivar and Fehérvári 1966: 42–44, 46, fig. 2); thus we cannot be certain whether we are dealing with a mosque, a different Islamic or a pre-Islamic building. It is worth noting that the hall's NNW-SSE orientation seems to be solely based on that of the fort platform. A more extensive geophysical survey may well shed significant light on the architecture of this important monument and should reveal how much of the interior space of the fort

it occupied. Without further survey or excavation the date and function of this monumental complex cannot be determined.

#### *OSL dating (JS and MF)*

Seven samples were collected for dating by optically stimulated luminescence (Huntley *et al.* 1985; Aitken 1998). These included three samples of brick (X2687, X2696 and X2698) taken from the walls (two from the Gorgan Wall and one from the Wall of Tammishe) at three different locations, as well as two sediment samples (X2685 and X2690) collected from one kiln each next to either wall believed to have been used for the manufacturing of the bricks. Two additional sediment samples (X2694 and X2697) (one each from the Gorgan Wall and the Wall of Tammishe) were collected directly below the walls from material under the walls foundations, likely to predate their construction.

On-site radioactivity measurements were made with a portable gamma-ray spectrometer and samples were processed at the Luminescence Dating Laboratory at the Research Laboratory for Archaeology and the History of Art, University of Oxford. The concentration of radioactive elements within each sample was determined by ICP-MS using a fusion preparation method (Kerrick and Wyman 1996). The results of the geochemical analysis were used to calculate the beta dose rate within the sample, whereas the external gamma dose rate was obtained from the situ-measurements. Further details regarding individual samples are presented in Table 1.



TABLE 1. Details of samples collected for OSL dating.<sup>9</sup>

Field code	Lab. code	Type of sample	Longitude	Latitude
KIL05-01	X2685	Fired sediment at the base of the excavated Gorgan Wall brick kiln, tr. A (Fig. 11)	55°43.530'E	37°32.241'N
KIL05-03	X2687	Brick from Gorgan Wall near the excavated Gorgan Wall brick kiln, 7th course (of 13 courses) from the bottom, tr. E (Fig. 14)	55°43.523'E	37°32.234'N
KBT05-03	X2690	Infill of kiln chamber of excavated Tammishe Wall brick kiln, tr. F: F.011 (Fig. 35)	54°03.651'E	36°43.846'N
TAW05-01	X2694	Sediment below foundations of Wall of Tammishe (Fig. 31)	54°02.855'E	36°46.014'N
TAW05-03	X2696	Brick from Wall of Tammishe (Fig. 31)	54°02.855'E	36°46.014'N
GOR05-01	X2697	Sediment below foundations of Gorgan Wall near Gonbad-e Kavus	55°11.214'E	37°17.038'N
GOR05-02	X2698	Brick from Gorgan Wall near Gonbad-e Kavus	55°11.214'E	37°17.038'N

TABLE 2. Results of the geochemical analysis of individual OSL samples by fusion ICP-MS and their moisture contents.

Sample code	K %	U (ppm)	Th (ppm)	Moisture content (%)
X2685	1.69	2.9	9.1	4.4
X2687	1.69	2.1	9.1	1.9
X2690	2.10	2.2	11.5	22.9
X2694	2.28	2.2	11.6	19.6
X2696	2.66	2.2	12.3	28.7
X2697	1.82	2.6	8.9	11.2
X2698	1.50	2.3	8.6	9.5

Results of the geochemical analysis are presented in Table 2 and final age estimates and radioactivity data are shown in Table 3.

The results shown in Table 3 are based on luminescence measurements of sand-sized quartz (90–125µm and 180–255µm). Samples were measured using a SAR OSL protocol (Murray and Wintle 2000). Except for the samples of brick, the dose rates were calculated using the concentrations of uranium, thorium and potassium as determined by fusion ICP-MS analysis (for the beta dose contribution) and *in-situ* radioactivity measurements (for the gamma dose contribution). For the former the dose rate was exclusively derived from the elemental concentrations derived by ICP-MS. Corrections were made in the age calculation for the water content of the sediment

TABLE 3. Summary of OSL dating results and radioactivity data.

Lab. code	Palaeodose (Gy)	Dose rate (mGy/a)	Archaeological significance	Age (years before 2006)	Age (B.C./A.D.)
X2685	4.69±0.09	2.98± 0.15	Construction of Gorgan Wall	1570±90	A.D. 346–526
X2687	4.43±0.12	2.87±0.15	Construction of Gorgan Wall	1540±90	A.D. 376–556
X2690	5.82±0.58	3.23± 0.17	Construction of Tammishe Wall?	1800±210	5 B.C.–A.D. 416
X2694	67.60±5.41	2.920±0.15	Deposit predating Tammishe Wall	23300±2300	23595–18995 B.C.
X2696	6.42±0.26	3.23± 0.19	Construction of Tammishe Wall	1990±150 [1580±120]	135 B.C.–A.D. 166 [A.D. 306–546]
X2697	4.64±0.12	2.80± 0.15	Deposit predating Gorgan Wall	1660±100	A.D. 246–446
X2698	4.21± 0.04	2.60± 0.14	Construction of Gorgan Wall	1620±100	A.D. 286–486

TABLE 4. Charcoal analysis of well stratified samples.

Sample	Context	Description	Taxa identified
<i>Gorgan Wall Brick Kiln</i>			
A.002	A.010	Bottom fill of kiln	42 x <i>Zizyphus</i> sp.
A.003	A.010	Bottom fill of kiln	22 x <i>Zizyphus</i> sp.
<i>Tammishe Brick Kiln</i>			
F.013	F.011	Fill of kiln	1 x <i>Juglans/Pterocarya</i> sp. 1 x unidentified ?shrub
F.014	F.011	Fill of kiln	3 x <i>Juglans</i> sp. 3 x unidentified ?shrub (similar to F013)
F.015	F.011	Fill of kiln	2 x <i>Juglans</i> sp. 1 x <i>Carpinus</i> sp.
F.016	F.011	Fill of kiln	4 x <i>Juglans</i> sp.
F.017	F.011	Fill of kiln	1 x unidentified ?shrub (similar to F013)

samples using the conversion factors of Adamiec and Aitken (1998). The contribution of cosmic radiation was calculated as a function of latitude, altitude, burial depth and average over-burden density according to the formulae of Prescott and Hutton (1994).

For all the OSL samples in this series the observed luminescence characteristics were highly suitable for OSL dating and strongly suggest that the palaeodose estimates and the calculated dates are likely to be reliable.

For the brick sample from the Wall of Tammishe (X2696), the date of  $1990 \pm 150$  may represent an overestimate of the true age. A very high moisture content was determined for this sample and it is likely that the modern measurement does not reflect the average water content of the sample through the burial period. The

bricks at this location showed clear signs of *in situ* weathering leading to increased porosity within the sample. Using a similar water content to that present within the other two brick samples the age for this sample is reduced to  $1580 \pm 120$ . Due to post-depositional changes in porosity of the bricks and the resulting increased ability to absorb water, the reliability of the OSL dates from the Tammishe Wall may be slightly reduced compared to those from the Gorgan Wall. Samples collected from unaltered bricks at a different location should enable one to clarify the situation in the future.

Sample X2694 is clearly unrelated to any deposit associated with the building of the wall and simply represents the depositional age of the underlying parent material.

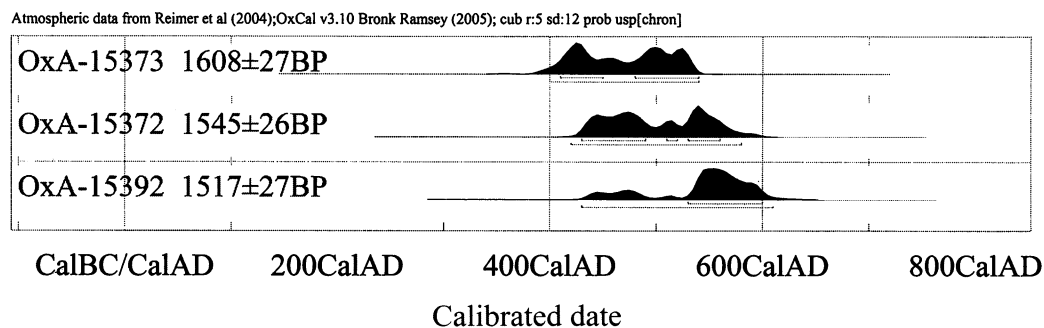


Fig. 39. Radiocarbon curves by Dr Tom Higham.

TABLE 5. Samples for radiocarbon dating (charcoal identified by rg).

Lab. Code	Trench & SF no.	Type of sample	Description of context	Longitude	Latitude
OxA-15372	Tr. A A.003	Charcoal (young <i>zizyphus</i> roundwood) (RG)	A.010: Bottom fill of the excavated Gorgan Wall brick kiln (Fig. 11)	55°43.530'E	37°32.241'N
OxA-15373	Tr. F F.014	Unidentified shrub from very young stem or twig (RG)	F.011: Fill of the excavated Tammishe Wall brick kiln (Fig. 35)	54°03.651'E	36°43.846'N
OxA-15392	Tr. B B.052	Animal bone: sheep/goat mandible (identified by Dr Julie Hamilton)	B.006: Fill of canal along the Gorgan Wall next to Kiani's fort 9 (Fig. 22)	55°13.688'E	37°18.443'N

TABLE 6. Samples for radiocarbon dating (dated by Dr Tom Higham, RLAHA, University of Oxford).

Lab. code	d13C	Archaeological significance	Uncalibrated dates (years before 1950)	Calibrated dates (68.2% probability)	Calibrated dates (95.4% probability)
OxA-15372	-24.1	Construction of Gorgan Wall (burning of bricks for the wall)	1545±26	A.D. 436–560	A.D. 429–574
OxA-15373	-26.4	Construction of Tammishe Wall (burning of bricks for the wall)	1608±27	A.D. 412–532	A.D. 402–537
OxA-15392	-20.2	Occupation of fort 9(?)	1517±27	A.D. 535–99	A.D. 433–610

*The identification of charcoal deposits from the Gorgan Wall and Tammishe brick kilns (RG)*

Samples for charcoal analysis were collected from the Gorgan Wall brick kiln and Tammishe Wall brick kiln and identified prior to C14 dating. The samples mostly contained several fragments of charcoal, with some pieces measuring up to about 20 mm. in length. Preservation of the charcoal varied from fairly firm to very friable and crumbly. Two samples included intact cross-sections of roundwood; it was difficult to assess the maturity of the remaining wood. The samples were prepared using standard methods (Gale and Cutler 2000). Anatomical structures were examined using incident light on a Nikon Labophot-2 compound microscope at magnifications up to x400 and matched to prepared reference slides of modern wood.

Samples from the bottom fill of the Gorgan Wall kiln (context A.010), were extremely friable and crumbly. Both samples were identified as *Zizyphus* sp. This large genus includes shrubs and trees, some of which produce edible fruits. It was not possible to identify the charcoal to species level.

Samples from context F.011 under the arches of the cross walls of the grill of the Tammishe Wall kiln, included *Juglans* sp. (walnut) and an unidentified shrub. One fragment was identified as a member of the family *Juglandaceae*; this could have been either *Juglans* with slightly atypical structure or the closely related *Pterocarya* (wingnut). One sample also included *Carpinus* sp. (hornbeam).

*The absolute dating of the Gorgan and Tammishe Walls (ES and JN)*

In addition to the optically stimulated luminescence dates, three radiocarbon samples were processed (Fig. 39) which are listed in Tables 5 and 6.

The radiocarbon and OSL dates proved to be compatible. Three OSL and one radiocarbon date were available for the production of bricks for the Gorgan Wall. The OSL dates (A.D. 346–526, A.D. 376–556 and A.D. 286–486) and the radiocarbon date (A.D. 429–574 at 95.4% probability) all point to a Sasanian construction date, and we can safely rule out that the wall was

Parthian. All four date ranges overlap in the period of A.D. 429–86, which suggests that it was built in the 5th century A.D. It is, however, worth stressing that three of the dates, including the radiocarbon date, also allow for an early-6th century and two even for a mid-6th century construction. While the 5th century seems much more probable, we should not exclude the possibility that the wall was created in, or construction works continued into, the early to mid-6th century. It is also worth noting that the earliest of the four samples (A.D. 286–486) derives from the westernmost location. Without further scientific dates we have to allow for the possibility that the western sections of the wall (e.g. from the Caspian Sea to the Arab Dagh) was built earlier and the easternmost section (whose dates overlap in the period from A.D. 429–526) later, perhaps when the dangers of a hostile force bypassing the system east of the Arab Dagh became apparent. Yet, the overlap between all four dates is sufficient for a single-phase construction, even if, depending on the size of the workforce, the project may still have taken several years or even decades. The striking similarity in the architecture of the wall and the rectangular brick kilns in the easternmost section and near Gonbad-e Kavus, referred to above, argues against two or more phases of construction works. The evidence presently available proves that the wall is late Sasanian and it suggests that it was built in its entirety in the 5th century A.D. (even if we cannot exclude the possibility that the monument was only completed in the 6th century or even, though this seems unlikely, that it was built in its entirety in the 6th century).

Our confidence in the reliability of these dates is further increased by the observation that the relative stratigraphic sequence of the samples is matched by that of their earliest and latest possible absolute dates: one OSL date for a deposit predating the wall (A.D. 246–446) is, in relative terms, earlier than any of the scientific dates for the construction of the wall, while one radiocarbon date from an animal bone, thought to represent waste by the garrison of fort 9 (A.D. 433–610 at 95.4% confidence), is later. Both, incidentally, derive from the central/western section of the wall. The animal bone is one of many from the infill of the more shallow canal leading along the wall. Its location proves that its deposition postdates the drying-up of this canal, after which rubbish was allowed to accumulate in the dry canal and defensive ditch. In all probability it represents waste by a late garrison of the fort, even if redeposition of earlier material cannot be ruled out with certainty.

The two OSL dates for the construction of the Tammishe Wall (5 B.C.–A.D. 416 and A.D. 306–546) and the radiocarbon date (A.D. 402–537 at 95.4% confidence) equally overlap. Yet, it is worth stressing that, as a result of the porosity of the brick and wet weather conditions at the Tammishe Wall during our fieldwork, the OSL dates were based on an estimate of the average moisture content during the burial period. It thus would seem hazardous to argue that the wall was necessarily built in the short period when all three dates overlap (A.D. 402–16). There is, however, no reason to doubt the reliability of the radiocarbon date and it is reassuring that at least one of the corrected OSL dates points to a similar date range. It is impossible to tell when precisely within the period of A.D. 402–537 the wall was built; it could be slightly earlier or later than the Gorgan Wall or roughly contemporary. Notwithstanding the fact that its associated ditch was west-facing and thus directed against another threat than the Gorgan Wall, the close architectural similarities between the two walls and their associated installations suggest that they are both part of the same large-scale building programme, which may have encompassed other walls further west, such as the Darband Wall, which has yielded late Sasanian inscriptions (Gropp 1975; Harmatta 1996: 82–83) and is equally thought to date to this period (Braund 2000: 1256–57; Kettenhofen 1996: 16; Kleiss 2001: 104; Stronach 1996).

It is worth noting in this context that the unusual large square bricks used in the Tammishe Wall are on average of marginally smaller dimensions (36 to 40 x 36 to 40 x 8 to 10 cm.) than those in the Wall of Gorgan (40 x 40 x 10 cm.). The observation that for either wall consistently bricks of similar size were used, albeit some broken bricks being employed as well (Kiani 1982b: 17; Bivar and Fehérvári 1966: 42), adds further strength to our assumption that the original construction of either monument was accomplished within a single phase. Bricks of similar dimensions appear to have been widely used elsewhere in the Gorgan Plain, such as mud bricks measuring 36 to 40 x 36 to 40 x 8 to 11 cm. for the Sasanian fort on Tureng Tepe (Boucharlat and Lecomte 1987: 27, 45). It may not be without interest in this context that the mud bricks from the Kōne Kishman, Durnali and Changly forts in the Merv Oasis are similar in size as well,<sup>10</sup> even if these compounds are thought to have been constructed in the Parthian period, but occupied also in Sasanian times. The bricks from the Sasanian Wall at Haftavan measured 38 to 40 x 38 to 40



x 9 to 11 cm. (Burney 1973: 170–71), suggesting a remarkable degree of standardisation of brick production for military defences over wide geographic territories. That one OSL sample from below the foundations of the Tammishe Wall dates back to the last Ice Age, proves no more than that the foundations of the wall reached down to undisturbed loess formed in this period.

The observation that the two north-east Iranian walls are either contemporary or, at least, not far apart in time, makes one wonder whether the western terminal of the Gorgan Wall was not further west than has been suggested so far. Today the wall's traces seem to disappear about 5 km. east of the shore of the Caspian Sea. If, at this time, or not long before or after, the Tammishe Wall and the Darband Wall (Kettenhofen 1996: 16) extended into terrain nowadays flooded by the Caspian Sea, the sea-level must have been lower than today, leaving a gap of more than 5 km.(!) to bypass the Gorgan Wall in the west. It is worth noting that its most monumental late Roman counterpart, the Anastasian Wall west of Constantinople, leaves no gap at the coast and continues at its south end at least 200 m. beyond the current shore into the Sea of Marmara (Crow 2005: 3). Further research on the terminals of the Gorgan, Tammishe and Darband Walls, is thus a high research priority (Anon. 2006), and it seems likely that an over 5 km.-long western continuation of the Gorgan Wall still awaits discovery, bringing the overall length of the monument to over 200 km. (not even taking into account that it may also continue further into the Elburz Mountains in the east than known so far). Defensive logic and the indications for the walls being contemporary, suggest that they all continue to a similar depth below the current water level in the Caspian Sea, a theory which future fieldwork will hopefully confirm or correct. The hypothesis that sea-level fluctuations in the Caspian Sea support an early date for the Gorgan Wall (Huff 1981; Kiani 1982b: 38) is, in the light of the recent research on the marine transgressions and regressions of the Caspian Sea (see above) and the scientific dates for the Gorgan Wall, no longer tenable.

Our conclusion that Dr M.Y. Kiani's dating proposal has been some 500 to 600 years too early, does not lessen the value of his admirable and major contribution to the exploration of the Gorgan Wall, notably its architecture and course. The presence of redeposited pottery, thought or known to be of Parthian date, could in part have inspired this early dating proposal. Parthian pottery was found during the excavations in the 1970s in forts

12 and 13 and in their vicinity (e.g. Kiani 1982b: 19), but it is worth noting that fort 13 includes a large tepe, so that the presence of redeposited sherds associated with the occupation of the tepe cannot be excluded. Indeed a second artificial mound, Qaravol Tappeh, next to, but outside, fort 13, yielded a large quantity of early Parthian pottery (Kiani 1982b: 21, cf. fig. 14, pl. 4.3; Kiani 1984: 16). One wonders, incidentally, whether the location of fort 13, in immediate vicinity to forts 12 and 11—a unique cluster of forts, three within little more than a kilometre—may not suggest that we are dealing here with more than one phase. As there is no apparent logical reason for such a concentration of forces at this point, it is worth considering whether fort 13 might not represent a later addition to incorporate the high ground of a tepe within the defended perimeter.

#### *The historical context of the walls (ES and JN)*

The scientific dating for the Gorgan Wall is compatible with its attribution to king Peroz (A.D. 459–84) by Ibn Isfandiyār (1,2 = Browne 1905: 27; cf. Kiani 1982b: 11) and points in any case to a 5th-century (or, at the very latest, early 6th-century) A.D. date. Whether the 13th-century author was right in crediting this particular king with building the wall or whether it had been commissioned by one of his predecessors (or, less probably, successors), it is scarcely fortuitous that the scientific dates coincide with a prolonged military conflict between the Sasanian Empire and its northern neighbours. Already under Bahram V (A.D. 421–39) and Yazdgerd II (A.D. 439–57) the Sasanian Empire had been at war with its northern neighbours, probably the Hephthalites (Frye 1983: 145–46; Schippmann 1990: 43). The precise locality of these events is disputed, but Ghirshman (1948: 85–86) has suggested that some of the Empire's opponents under Yazdgerd II have to be sought in the area north of Gorgan. The conflict reached a climax under king Peroz (A.D. 459–84), who eventually lost his life fighting against the Hephthalites in A.D. 484. An extract from Procopius's *Persian War* (1,3,1–3) on Peroz's first campaign (c. A.D. 465–69; Schippmann 1990: 44) provides us with valuable clues about the location of the events: "Later, Perozes, the king of the Persians, fought a war over borderland against the Hunnic people of the Hephthalites, whom they call the Whites; therefore, having gathered a strong army, he marched against them. The Hephthalites are

Huns, ethnically as well as in name, yet they neither have contact with nor visit any of the Huns known to us, since they neither possess territory neighbouring them nor do they live anywhere near them, but they dwell near the Persians and towards the north of them, where in fact a town called ‘Gorgo’ is located near them, somewhere in the furthest stretches of the land of the Persians; here they have become accustomed to fight against each other over border territory. For they are no nomads, like the other Hunnic peoples, but have settled on good land since ancient times.” The first campaign culminated in an encounter between the Persians and the Hephthalites, interestingly in an area with precipitous mountains, very densely covered in wide-spreading trees (Procopius, *Persian War* 1,3,8–9), a landscape description which would fit the Elburz Mountains or mountain ranges further east (but not the steppe zone further north).

During the second campaign against the Hephthalites under Peroz the Persians passed once again through their border town “Gorgo” (Procopius, *Persian War* 1,4,10). The contemporary late 5th-century Armenian author Łazar (85/155 = Thomson 1991: 214) reports that Peroz was “gathering troops from all sides” while he was in “Vrkan”, i.e. Hyrcania or the area of Gorgan (Wiesehöfer 2005: 653; cf. Bivar 2003: 151). Procopius’s “Gorgo” is normally identified with the ancient town of Gorgan or Jorjan (Lippold 1974: 134; cf. Kiani 1984) near Gonbad-e Kavus (and not to be confused with the modern administrative centre of Gorgan, formerly Astarabad). Bivar (2004: 199, contrary to Bivar 2003: 152–53) argues against this proposed identification, as being incompatible with a report by Łazar (85/156 = Thomson 1991: 215) on events following Peroz’s defeat and death in A.D. 484: “a few men escaped from the slaughter; reaching Vrkan they told everyone of these grievous events”. Bivar (2004: 199) postulates that “it thus appears that the Hephthalites did not reach Gorgan, and the reference may rather be to Gorganj/Jorjaniya in Choresmia.” Yet, it is difficult to follow this argument. It is possible that the cause of the confusion is that the most widely used English translation of Procopius once wrongly attributes “Gorgo” to the Hephthalites (Dewing 1914: 15), but elsewhere rightly to the Persians (Dewing 1914: 23), while the Greek text implies that it was under Persian control on both occasions (Procopius, *Persian War* 1,3,2; 1,4,10) and a staging post on the second campaign. According to Łazar, “Vrkan”, which was on

a major route to Merv and the east (cf. Tabari 819 = Bosworth 1999: 15), was even the launch platform of Peroz’s second campaign. It was at “Gorga”, which must equally refer to ancient Gorgan, that Peroz received the Roman ambassador Constanti[n]us whilst at war with the Kidarite Huns (Priscus, *Exc. De Leg. Rom.* 12 [Blockley 1983: 348–49]; cf. Harmatta 1996: 81). The battle itself took place somewhere beyond, in the land of Hephthalites. The extent of the territory controlled by the Hephthalites, especially in the west (Lippold 1974: 135–36; cf. Altheim and Stiehl 1970: 695), is a matter of academic debate, but it appears to have comprised extensive areas north of the Elburz Mountains and the Hindu Kush, possibly including much or all of the Amu Darya’s basin (Veh 1970: 459–60); they minted later coins at Balkh (Alram 2004). That some survivors after the battle of A.D. 484 fled back to the launch platform of the campaign following what may have been the only route familiar to them (i.e. the one they had taken when invading Hephthalite lands) makes perfect logical sense; all it proves is that the Hephthalites did not take, or had not yet taken, advantage of their victory by launching a counter-attack. Indeed, the report by the surviving soldiers caused, according to Łazar (85/156 = Thomson 1991: 215), panic and fear that the Hephthalites might be about to do so and the flight of Vrkan’s population, its upper and lower classes alike. If the construction of the Gorgan Wall predates the battle of A.D. 484 (as the scientific dating suggests), then the troops Peroz had, according to Łazar, gathered from all sides at Vrkan prior to the campaign, may well have included parts or all of the garrison of the forts, leaving the Gorgan Plain depleted of adequate protection.

There is thus no strong reason to doubt that the Persian army under Peroz during both campaigns against the Hephthalites passed through the ancient town of Gorgan, that it was not too far from the border of the Persian Empire, that there were frequent wars resulting from border disputes in the area and that it had immense strategic significance. The latter, no matter when precisely construction works on the wall within the 5th century started and when they were completed, undoubtedly was one of the main factors behind this ambitious project.

We should, however, not necessarily assume that, even if Hephthalite territory extended far to the west, it started immediately north of the Gorgan Wall. It seems much more probable that the area under Persian



Fig. 40. The substantial ditch west of the Wall of Tammishe.

dominion extended well beyond the wall. The wall's course was determined by hydraulic engineers who created a major water supply system alongside it. Thus they had to find a route following, for much of the wall's course, the natural gradient of the terrain and one in proximity of riverine water supply and the intended distribution zone. The wall's course marked at the same time the northern edge of the most fertile, densely settled and prosperous land; the wall was thus in an ideal position to protect it (including all of the Gorgan River valley), and the wall's large garrison could easily be supplied with food. Had, by contrast the wall been built further north, e.g. in similar latitude as the Darband Wall, then it would have had to be extended to a length well in excess of 1000 km. to reach an unsurmountable natural obstacle in the east, and would have required a far larger garrison, which would have been hard to feed at such remote outposts.

A minor point worth mentioning is that the Hephthalites, when awaiting a second invasion by the Persians, are reported to have dug in a plain a long, deep and wide ditch and covered it with reeds and soil as a trap for the invading Persian army. The reports, claiming that the entire Persian army perished, falling in a literal sense into this deep ditch somewhere in Hephthalite territory (Procopius, *Persian War* 1,7–14; Łazar 85/156 = Thomson 1991: 215; Agathias 4,27,4; cf. Tabari 876, 879 = Bosworth 1999: 115, 119), are hardly credible. Yet, it is possible that the legend reflects one way or the other that linear barriers played a significant part in military conflicts in the area, where such monuments had a long tradition (Ball 2000: 315; Rakhmanov 1994), as they did

in Iran (Kleiss 1999; 2001). Despite such legendary embellishment, there can be no serious doubt that the reports on the scale of the military conflict on the Persian Empire's northern border have a true core. Procopius probably used reliable sources for the first campaign (Cameron 1985: 154), and there is also independent archaeological evidence: coins of Peroz were later used for large-scale imitation by the Hephthalites, and this has been plausibly explained with the influx of Persian money under his reign on an unparalleled scale as a result of the wars (Göbl 1967: 90; Alram 2004: 573).

The strategic purpose of the Wall of Tammishe must have been different. Its ditch being to the west of the wall (Fig. 40), the wall's primary function was hardly to protect the fertile land on the southern shore of the Caspian Sea from incursions from the north-east. The narrowness of the land corridor between the Sea and the mountains may have provided a convenient location for a hinterland defence, and the threat may have emanated from beyond the Caucasus rather than the immediate vicinity of the wall. The function of this Persian barrier may have been similar to the late Roman long walls, e.g. the Thracian Long Walls near Constantinople or the wall across the Isthmus of Corinth (Crow 1986; Gregory 1993), far from the boundaries of the Eastern Roman Empire, but in an ideal position to protect vital core territories. Whether the Tammishe Wall predates the above-mentioned longer Darband Wall, further north, on the western shore of the Caspian Sea, or whether it postdates it, is unknown, nor do we know the chronology of a series of linear barriers between these two on the western coast of the Caspian Sea (Braund



2000; Howard-Johnston 1995: 192–93). In the former case it initially formed a primary line of defence, in the latter, a secondary barrier (in case any hostile forces should have managed to storm or bypass the Darband Wall and/or any of the other barriers in between). Whatever the precise relative chronology, Harmatta (1996) has made a powerful case that the Darband and Gorgan Walls, as well as the walls around Merv, formed part of a unified “*limes Sasanicus*”. He may well be right that Peroz played a key role in establishing it, and most of the system was in any case late Sasanian. Whilst not forming a close architectural parallel to the northern linear barriers or being directed against the same group of enemies, it is worth noting that Howard-Johnston (1995: 190–97) argues that the Sasanian Empire’s flexible defensive system also included canals in Mesopotamia and a string of blockhouses in Sistan; the latter, however, are only tentatively assigned to the Partho-Sasanian period (Fischer *et al.* 1976: 255–56; Stein 1928: 972–79), and may, quite possibly, have been intended to safeguard internal security rather than an external border.

The extraordinary scale of the walls protecting the north-western borders of the Sasanian Empire demonstrates that the threat posed by its northern neighbours, notably the Hephthalites and other Hunnic groups, was significant and real. The sources, while reflecting largely a Roman perspective and thus referring to the Caspian Gates rather than the walls further east, equally leave no doubt that the defence against this northern threat featured prominently in the relations between the Persian and Eastern Roman Empire. The Sasanian state repeatedly demanded (and on several occasions received) Roman financial contributions to the upkeep of the defences in the Caucasus against the Huns, as these barriers helped to protect the north-eastern provinces of the Eastern Roman Empire as much as the

north-western territories of Persia (Blockley 1985 with references). Particularly interesting in our context is that, according to the chronicle of Pseudo-Joshua the Stylite (8–10; cf. Blockley 1985: 66–67), the Romans made financial contributions to king Peroz’s military undertakings against the Huns, i.e. probably also the Hephthalite Huns.

It seems unfashionable today to discuss the military function of linear barriers and scholarly discussion often focuses on their symbolic significance instead. Sometimes the alleged ineffectiveness of such barriers is deliberately emphasised (e.g. Lovell 2006: 44–45). We are inclined to differ. Literary sources often focus on major catastrophes, e.g. devastation caused by invasion armies, and pay frequently little, if any, attention to when these monuments served their purpose (e.g. Procopius, *Persian War* 2,4,4–11 referring to instances of subgroups of the Huns being able to storm or bypass such fortifications in A.D. 540, but not spelling out that the Peloponnesians were probably saved by the wall across the Isthmus of Corinth [cf. Cameron 1985: 220–21; Gregory 1993; Whitby 2000: 715]). Yet, there is still significant literary evidence for instances when linear barriers prevented invasions or, at least, made them more difficult (Sauer 2005: 37–42). That even sophisticated linear barriers were only effective, if they were adequately garrisoned and patrolled, and that even then they were not impregnable is self-evident. However, instances of enemies managing to break through such barriers do not disprove that they could considerably reduce the number of such incidents and considerably raise the threshold, in terms of military strength and risks, for enemies attempting a raid beyond such a line, especially if they lacked experience in siege warfare or launching an effective sea-borne attack. The observation that forts are found on all sections of the Gorgan Wall (and probably near either terminal of the Tammishe Wall), leaving no obvious weak point, indicates that they were designed as effective border control and defence systems, with an adequate number of soldiers on guard along each section of the Gorgan Wall to be able to repel surprise attacks.

The size of the compounds suggests a substantial army. The combined size of Kiani’s 33 forts amounts to some 113 ha., enough space for some 30,000 to 40,000 men, if the garrison of similarly-sized Roman compounds provide a valid comparison (Table 7).

It is interesting to note in this context that the 3rd-century Roman historian Herodian (3,1) thought, rightly

TABLE 7. Comparison between the Gorgan Wall and Hadrian’s Wall.

Monument	Hadrian’s Wall <sup>11</sup>	Gorgan Wall
Length	120 km.	195 km.+
No. of forts	15 <sup>12</sup>	33+ <sup>13</sup>
Combined size of forts	c. 28.7 ha.	c. 113.1 ha.+ <sup>14</sup>
Estimated garrison	9,500	Unknown 37,500?? <sup>15</sup>



or wrongly, that the Parthians had no paid soldiers or standing army. This view has been adopted by modern scholarship; while it is assumed that there were forts with standing garrisons under the Parthians, the centralised standing military force is considered to be a Sasanian creation (Shahbazi 1987: 494, 496). The main strength of the Parthian and Sasanian field army is normally thought to have lain in its cavalry (Schippmann 1990: 103–6; Shahbazi 1987: 494–99; Widengren 1976: 295–97). Since highly mobile societies and mounted opponents from the areas north of the wall posed the greatest threat to the Gorgan Plain, it seems reasonable to assume that also a high proportion of the garrison defending the wall consisted of similarly mobile horsemen. If so, a percentage of the area of the forts may have been needed for accommodating horses, and the overall garrison may have been somewhat lower than the model above suggests, but will still have been substantial. The occupation density of Roman cavalry forts at least appears to have been on average (but by no means always) slightly lower than that of their infantry counterparts (Johnson 1983: 292–93). Until excavation gives a better idea of the density and layout of the interior occupation of the Gorgan Wall forts, hypothetical estimates of the size of the forts' garrison will remain speculative, but there can be little doubt that it reached a substantial five-digit figure. If we are right in thinking that tens of thousands of soldiers were stationed at a single frontier, then the size and level or organisation of the Sasanian army may well have been under-estimated by ancient and modern authors. The Sasanian military forces appear to have included a substantial number of professional soldiers and a range of specialists, in tasks ranging from surveying and engineering to siege warfare (e.g. already at Dura-Europos, some 200 years earlier: James 2004: 30–38). The Sasanian army was almost certainly, in terms of numbers and skills, amongst the strongest of its time (cf. Howard-Johnston 1995: 165–69, 185–86), a fact which is powerfully reflected in the massive size of the Sasanian Empire.

Of course, the way their creators intended these barriers to function, and how they were perceived by the Empire's enemies, cannot be fully explained by modern rationalism alone; there must have been an element of symbolism as well. A high wall running for some 200 km. or more and lined by massive forts, undoubtedly left a deep impression, of the military, organisational and architectural capabilities of its creators, on the wall's northern neighbours—all the

more so as there were no major artificial obstacles or mountain ranges restricting movements across the Eurasian steppes for thousands of kilometres beyond it. Yet, it would be misguided to ask whether the wall served more a symbolic or a real practical function, as the two are inextricably linked. The more effective and sophisticated the system, the more powerful it would have been as a symbolic statement of superiority and as a keep-out sign.

Nicola Di Cosmo (2002: 139–49) and Julia Lovell (2006: 43) have recently questioned that China's ancient linear barriers were indeed built to "resist the barbarians", in the light of their often remote location: "Indeed, the position of these walls gives the sense that they were designed not to defend China but to occupy foreign territory, to drive the nomadic inhabitants out of their land and to facilitate the setting up of military posts that would police the movement of people across these areas" (Lovell 2006: 43). Were the Gorgan and Tammishe Walls similarly monuments to the strength rather than the weakness of their creators? According to Pseudo-Joshua the Stylite (*Chronicle* 10 = Trombley and Watt 2000: 10), even if he (over?) emphasises the role of Roman financial subsidies, Peroz's military campaigns against the Huns (including the Hephthalite Huns?) had not been as unsuccessful as other biased western sources would have us believe. Indeed, it appears that the Persians for a long time had the upper hand in the conflict: "Peroz subdued the Huns, seized many places within their territory, and added them to his kingdom". We cannot be certain whether it was Peroz or one of his immediate predecessors, who built the Gorgan Wall, nor whether the territorial acquisitions referred to by Pseudo-Joshua might have included reconquered land in the Gorgan Plain, but we can be certain that the creation of a wall on this scale with over 30 large forts on raised platforms surrounded by massive ditches and requiring a huge garrison along a route chosen by hydraulic engineers was not a hasty act in response to pressure; instead it bears the hallmarks of a powerful demonstration of military superiority and an effective security measure against future threats. That the Gorgan Wall was combined with one of the most ambitious and large-scale water supply systems in the ancient world equally suggests that its creation was by no means a desperate emergency measure, but part of a calculated and sophisticated programme by a powerful Persian Empire to maximise and safeguard the prosperity of the Gorgan Plain in the 5th century (probably predating the events of A.D. 484).

While the literary records are too sketchy to allow us to assess how effective or ineffective the Sasanian border defences were, one cannot help the impression that this system was remarkably sophisticated and, by and large, fulfilled its purpose, notwithstanding occasional setbacks, such as Peroz's defeat in A.D. 484. His misfortune outside territory protected by the Gorgan Wall appears to have been the result of strategic mistakes and carelessness out of overconfidence, conceivably even in part based on the proven effectiveness of the Sasanian defensive system. It is worth noting that in Late Antiquity neither the Western nor the Eastern Roman Empire created linear barriers anywhere near the scale of the Gorgan Wall. Of course, the geographic setting was different (cf. Howard-Johnston 1995: 196–97). The magnitude of the Caucasus and Elburz Mountains allowed the Sasanian Empire to shield its northern boundaries by filling the gaps with linear barriers. To create a similarly effective system along the Danube and Rhine would have required much longer linear barriers and a much larger garrison, probably beyond the capabilities of the Western and Eastern Roman Empire. That the European provinces of the divided Roman Empire were hard hit by Hunnic invasions may well be in part the result of the effectiveness of the Sasanian long walls, even if their precise chronology requires further research before we can relate them to specific historical events and can be certain about cause and effect. We also do not know yet when precisely the walls were abandoned, though there is as yet no evidence to suggest that their occupation continued beyond the Sasanian period. It is worth noting that the faceted glass tube from Kiani's trench F (Kiani 1982b: 37, fig. 29) dates to the early 7th century (Dr St John Simpson, pers. comment). While a single item does not necessarily prove that the fort in question, let alone all forts, was or were still occupied then, neither is there as yet evidence to the contrary. If they were still operational around A.D. 540, then they may help to explain why the Sasanian Empire could concentrate its military forces on a successful invasion of Rome's eastern provinces. The impression remains that the Gorgan, Tammishe and Darband Walls were a strategic masterpiece by a powerful Persian Empire, which managed to protect, maintain and expand its dominion. At the same time, the Western Roman Empire was carved up by its Germanic successor states and eventually ceased to exist; and, even though it survived, the Eastern Roman Empire was substantially weakened, being unable to protect itself against a series of major invasions.

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The key members of the expedition are listed below (in the first footnote), but we are equally grateful for the essential contribution by our workmen, drivers and all other supporters of the project, space does not allow us to list.

# Notes

- <sup>1</sup> The team of the Iranian Cultural Heritage and Tourism Organisation of Golestan Province consisted of Ghorban Ali Abbasi, Mohammad Ershadi, Maryam Hussein-Zadeh, Elahe Keshiri, Abul Qassem Lessani, Majid Mahmoudi, Mohaddeseh Mansouri Razi, Alireza Hesar Navi, Amin Nazifi, Hamid Omrani Rekavandi and Rajab Mohammad Zaruri and was directed by Jebrail Nokandeh, the team led by the University of Edinburgh consisted of David Parker, James Ratcliffe, Jean-Luc Schwenninger, Lucian Stephen Usher-Wilson and Tony Wilkinson and was directed by Eberhard Sauer. The OSL samples were taken and analysed by Jean-Luc Schwenninger and Morteza Fattahi.
- <sup>2</sup> 3,600 (120 x 30) readings per grid were taken by the magnetometer, as opposed to 900 (30 x 30) by the resistivity meter. The 30 x 30 m. grid system and settings were also applied to other surveys, unless otherwise stated. The climate during our investigations at fort 1 was largely hot and dry, though there were episodes of cloud cover and some nightly rainfall. The dryness of the ground may have had an adverse impact on the resistivity survey, the midday heat on some days on that of the magnetometer survey. The results were processed using Archeosurveyor and Geoplot (as were those of the other surveys).
- <sup>3</sup> Similar observations were incidentally also made when, in the 16th century, the Great Wall of China began to be constructed in stone or brick (Waldron 1990: 141; cf. Matson 1985 for much earlier evidence from Mesopotamia).
- <sup>4</sup> At the contemporary hinterland fort of Tureng Tepe a piped drain (the pipes being of 14–23 cm. diameter) led out of the gate (Boucharlat and Lecomte 1987: 27, 30–31, pl. 7, 115b, 118a–19a).
- <sup>5</sup> The site of Qizlár Qaleh is between forts 29 and 30 and on Kiani's map (Kiani 1982b: 8a) named as Qarniaregh Q.
- <sup>6</sup> The sandy horizon, being only some 4–5 m. below sea level, is unlikely to represent a high level of the Caspian during the Holocene, and is more likely to represent the Late Pleistocene "Early Khvalynian" transgression or a

slightly later transgression. These are estimated to have occurred roughly 30,000 and 10,000 years ago respectively (Mamedov 1997: 163).

- <sup>7</sup> When the wall was originally built, the water table must have been very low, but in recent years it has become artificially raised by the introduction of large scale irrigation systems to the north and south of the wall. Ironically, these resulted in numerous problems of waterlogging during the excavation of the ditch.
  - <sup>8</sup> In any given length of ditch and wall, the volume of the soil extracted from the ditch beneath the ancient land surface, divided by the product of the same length of wall and its average width (at any level), including the outer courses of fired bricks, should provide an approximation of the height of the wall. To this one would probably have to add the breastwork.
  - <sup>9</sup> Standard sample preparation procedures were adopted which were designed to yield pure coarse-grained quartz (90–125µm; 125–180µm or 180–255µm). A single aliquot regenerative-dose protocol (Murray and Wintle 2000) was adopted for all the OSL measurements. The latter were made using automated Risø luminescence measurement equipment. Optical excitation was provided by filtered blue diodes (emitting ~410–510nm) and infrared stimulation was also provided using a single IR laser diode. Luminescence was detected in the UV region using an EMI 9635Q bialkali photomultiplier tube, filtered with Hoya U340 glass filters. Sample irradiation was provided by a calibrated sealed <sup>90</sup>Sr source.
- The mean palaeodose for each sample was obtained from twelve aliquots and all OSL measurements were made at 125°C (to ensure no retrapping of charge to the 110°C TL trap during measurement) for 100 seconds. The signal detected in the initial 1st to 2nd seconds (with the stable background count rate from the last 12 to 24 seconds subtracted) was corrected for sensitivity using the OSL signal regenerated by a subsequent beta dose ( $\beta_s$ ). To ensure removal of unstable OSL components, removal of dose quenching effects and to stimulate retrapping and ensure meaningful comparison between naturally and laboratory irradiated signals, pre-heating was performed prior to each OSL measurement. Following each regenerative dose ( $\beta_i$ ) and the natural dose, a pre-heat (PH<sub>1</sub>) at 220°C for 10s was used, whereas, following each test dose ( $\beta_s$ ), a pre-heat (PH<sub>2</sub>) of 180°C for 10s was applied.
- <sup>10</sup> 40 to 41 x 40 to 41 x 10 to 11 cm., 40 to 42 x 40 to 42 x 13 to 14 cm. and 41 to 42 x 41 to 42 x 12 to 15 cm. respectively: Bader *et al.* 1992: 237; 1994: 120, 123; Koshelenko *et al.* 1991: 170–71.

- <sup>11</sup> Source: Breeze and Dobson 2000: 54, 159–62.
- <sup>12</sup> Excluding those on the Cumbrian Coast, outpost forts and those in the hinterland.
- <sup>13</sup> Excluding three additional forts discovered after the 1970s, three probable fortlets and probably contemporary forts (Kiani 1982b; Boucharlat and Lecomte 1987) in the hinterland.
- <sup>14</sup> Source: Kiani 1982b: 15, fig. 9.
- <sup>15</sup> If occupied as densely as the forts on Hadrian's Wall.

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